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[OFFICIAL NOTICE.]

Thirtieth Annual Meeting of the New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Feb. 1, 1900.

To the Members of the New England Association of Gas Engineers: The Thirtieth Annual Meeting of the Association will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 21st and 22d. The call to order will be made at 10 A.M.

Members will please gather promptly in the meeting room (No. 12), so that the sessions may not be delayed.

The following papers are to be read:

"Then, Now and Later;" by Mr. John A. Waters, Stamford, Conn.

"Four Years' Experience with Prepayment Meters;" by Mr. N. O. Goulding, Natick, Mass.

"Pumping Gas Five Miles, at 20 Pounds Pressure;" by Mr. F. H. Shelton, Philadelphia.

"Some Notes on Oil and Tar Burners;" by Mr. B. J. Allen, Allston, Mass.

The Question Box content so far is as follows:

"What successful substitute for cast iron gas mains has the high price of iron developed?"

"Would a gas inspector be justified in 'passing' a job that had been made tight through healing a leak by cold water application?"

"Are wrought iron or steel tanks set on surface of ground considered better than brick and cement, or stone or cement tanks set in the ground, for gasholders? And is there much difficulty in the construction of the latter to prevent leakage?"

"In double stacks of retorts, which arrangement is preferable: To have the benches set back-to-back, or facing each other, with operating floor between?"

Members are urged to send in their questions for the Box well before the meeting, that they may be published, thus giving all a chance to join intelligently in one of the most useful features of the meeting.

It is suggested that members wear their badges at the meeting. Badges may be secured from the Treasurer.

The members will dine together as usual on Wednesday evening. Blank applications for membership may be obtained of the Secretary, and all matter to come before the Directors should be forwarded to the Secretary, not later than February 20th.

Friends of the Association are invited to attend the meeting.

N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

Seventh Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
RACINE, WIS., Jan. 17, 1900.

To the Members of the Michigan Gas Association: The Seventh Annual Meeting of the Michigan Gas Association will be held in the

city of Detroit, on Wednesday, the 21st, and Thursday, the 22d day of February next. Headquarters will be at the Russell House, where also the meetings of the convention will be held. Rates $3.50 and upwards per day for room with bath, and $2.50 and upwards without bath.

H. H. Hyde, Secretary.

BRIEFLY TOLD.

Obituary Note.—Mr. James Gardner, Jr.—The Journal for January 22d last contained brief mention of the death of Mr. James Gardner, Jr., who succumbed to a long and pluckily fought contest with disease the night of the 16th ult. The son of a man (Mr. William Gardner) who had been in the front rank for the establishment of the gas industry in America, and himself a man worthy of his father, it seems that a line or two respecting his career is more than merited. Deceased was born in Johnstown, Pa., in the first month of 1862, at which time his father was engaged in the reconstructing of the gas plant at that point. Subsequently, his father having completed that task, and the construction of the gas plants at Akron and at Canton, Ohio, and having located in Pittsburg, Pa., the son was taught in the public schools of Pittsburg, and completed his education in the Pennsylvania Military Academy, Chester, Pa. On leaving that institution deceased became a member of the engineering corps for the initial survey of the line now known as the Buffalo, Rochester and Pittsburg Railway, and later on in a like capacity on a branch of the construction of the Northern Pacific Railway through North Dakota. In 1883 he returned to Pittsburg to become a partner with his father in the proprietorship of the fire clay works, established by his father and uncle, under the firm name of Gardner Bro.'s, in 1864. At the time named (1883) the title of the firm was changed to that of William Gardner & Son, and five years thereafter the son succeeded the father as sole proprietor, under the title of James Gardner, Jr. The works of the concern, at Lockport Station, Pa., and its offices in Pittsburg as well, are known to every gas man who has had occasion to travel over the Pennsylvania Railroad system. In 1894 his health, which was never of the robust order, obliged him to remove to Colorado, where the end came, as noted above. He was elected to active membership in the American Gas Light Association at its meeting for October, 1883, and had been an associate member of the Western Gas Association since May, 1894. His next of kin is his mother, whose devotion to his father and to himself has been a marvel even to those who have seen many wives and mothers perform what seemed their whole duty to their own. The writer here adds his personal testimony to the fact that deceased was a genial, wholesome gentleman, and regrets very much that death called him so soon.

Notes.—George Shepard Page's Sons have removed their main offices from No. 69 Wall street to 180 Fulton street, New York. They always have the latchstring on the right side of the door, by which is meant that they are always ready to meet a gas man face to face.—— At the annual meeting of the Grand Rapids (Mich.) Gas Company the officers chosen were: Directors, T. J. O'Brien, A. G. Hodenpyl, H. Idema, J. M. Barnett, J. B. Pantlind, Lester J. Rindge, E. McMillin, N. L. Avery and H. D. Walbridge; President, Emerson McMillin; Vice-President, N. L. Avery; Second Vice-President, H. D. Walbridge; Secretary and Manager, Paul Doty. The Company's plans call for quite considerable main extension this year.——At the annual meeting of the Manchester (N. H.) Gas Light Company the officers chosen were: Directors, G. B. Chandler, Walter M. Parker, W. B Stearns, Henry Chandler and N. P. Hunt; President, G. B. Chandler; Treasurer, Walter M. Parker; Clerk, N. P. Hunt.—The Detroit (Mich.) *Journal* says the statement of the Detroit Gas Company, for the half year ended Dec. 31, 1899, shows that during the named period 147,004,600 cubic feet of gas had been manufactured and used on illuminating account. For the corresponding period of 1898 the amount reported was 133,137,800, and for the first six months of 1899, the amount was 135,971,100. The new gas ordinance provides that when the annual consumption shall reach 600,000,000 feet the rate shall be reduced.——At the annual meeting of the shareholders in the Berlin Iron Bridge Company, held at the office of the Company, East Berlin, Conn., last Monday, it was voted to increase the capital stock to $750,000. The following Directors were elected: Charles M. Jarvis, Frank L. Wilcox, H. H. Peck, S. H. Wilcox, Geo. H. Sage, D. E Bradley and Seymour N. Robinson.——We understand that the manufacture of illuminating gas will be discontinued in Jamestown, N. Y. ——Mr. William Turner, formerly in charge of the gas plant at Kingston, N. Y., is dead. He was in his 58th year. In 1860 he was in the employment of the Lynn (Mass.) Company.

[Prepared for the Journal.]

Gas and Electricity in Russia and Siberia.[1]

[By L. W. Lodian, C.E., Paris, France.]

Gas and electrical inspection and sight seeing I have done most all over the globe—from the suspicious and distrustful gas works of Iberia (mostly owned by French concerns) to the natural gas facilities of Sheffield-smoke Pittsburg; from the fine works of the spick and-span towns of Australia to the plants of squalid, Latin-American cities (where European hands figure prominently on the local police-sheets for drunken brawls); and from the model private works on residential estates in old Anglia, to the mammoth public reservoirs of the western world.

Where Electricity is Common, but Gas Unknown.—During the writer's journey overland from the Pacific to the Atlantic oceans, across Korea, Siberia, via Ural Mountains, to and across Russia, Poland and Germany, Belgium and France, I saw many things of interest to gas people. Thus—curious to relate—in the chief big towns of Siberia, passed en route during the trans-Asiatic survey of '96–97, not a single gas works was seen. Nearly all towns have almost model central stations for the arc lighting of the streets and the bulb lighting of the houses and stores. The vast majority of these Siberians have never seen gas, unless they have traveled into Russia, which comparatively few of them have done. To them gas is an illuminant of a past age—spoken about, may be, by those who have traveled west of the Urals. Yet, in the towns, they are quite familiar with the most scientific of illuminants; and bulbs and carbons they handle with familiarity. I never heard of an electrical mishap among them. It is true they largely wear high priced rubber overshoes most of the year, which are badly made by a monopolizing "Russian-American" concern at Petersburg, of adulterated or impure "rubber" (?)—or an excuse for it—lined with inferior red-dyed wool or shoddy; and so poorly dyed that the red comes out and will even stain the boots; while, if worn as a temporary make-do next the socks in the house, the socks are quickly discolored a dingy red or pink, which even soaks through and dyes the skin, and is liable to produce blood poisoning. These "rubber" shoes (despite their impurity) have been known to accidentally prove—that is, quite unintentionally—pretty fair non conductors.

Electric lighting having obtained a secure hold in Siberia, whether the modern incandescent gas lighting will ever be introduced into that country, I cannot say. I do not think it will be on any scale of note, for the reason that wood is and will be for many years to come cheaper than coal. Electricity can be obtained with wood as the heating agent for the boilers, but gas cannot be cheaply obtained from wood. With their expensive electric lighting stations now running in full trim, kept up to date by modern machinery and apparatus from France, Germany and Belgium, the Siberian townspeople are not likely to go to the expense of erecting works and trying the mantle gas rays. It would be all very well if the gas works were already built and in operation. Then the mantle would have its chance, and assuredly a successful one.

Incandescent Kerosene Lamp Lighting—But another kind of incandescent lighting, which I have not seen much in the Western world, but which is coming a deal into vogue in Eastern Europe and Siberia, is the mantle adapted to the kerosene lamps. This adaptation has already found its way trans-Uralwards. Where the Siberians do not use electricity they depend upon kerosene, brought thousands of miles overland from Batoum, in the extreme south of Russia. Throughout the Russian dominions kerosene is sold by weight—not by measure—at so much a pound. It is always poured into your bottle or container on the scale. The Russian system of selling liquids and many other articles by weight—even their heavy brass samovars or tea urns are sold by the *fynt* (pound)—is a meritorious one.

It was a French invention, I believe, this adaptation of the mantle to the kerosene lamp. Anyway, it is being gradually introduced into eastern Europe and Siberia, via the Ural ciepa, so that the good little mantle is doing for mineral oil what it cannot do—in Siberia—for mineral gas. The writer would not be staggered if, ere long, an ingenious gautois adapted the mantle to the ordinary democratic 2 cent candle, just as, a decade ago, a studious Seineite adapted mineral oil essence to percolate slowly from a little reservoir connected with and about a foot from an ordinary gas bracket. The oil graded by gentle gravity along the pipe of the gas bracket, and so up to the burner (all liquids finding their level); and the light so much resembled gas, that it required a little observation to discern the difference. The mineral essence simili-gas, as it is termed in Paris, is now well known all over the French capital, although I have never met with it elsewhere during my travels.

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Due to my Antipodean and Indiasian and Himalayan and Polynesian and trans-Asiatic travels of '94 to '97, I did not see the incandescent gas lighting till I arrived at Oofa, in East Central Russia, in May '97. Oofa is the first Russian town of importance you reach after crossing Siberia and the Ural Mountains, traveling to the West. It is a dirty, big village of some 20,000 people, without a single newspaper, other than the government official legal sheet annunciator. The majority of Russian provincial towns are big, dirty villages—or near to it—with streets that are all mire during wet weather, or all dust during dry weather. The only time the streets are clean is when they are under the winter snow-ice. It is not in a Russian to build a good street way or roadway.

Incandescent Gas in Russia.—Well, at Oofa and later, at Camapa, Tyla, Mockfa, St. Petersburg and Warsaw, I saw the incandescent gas for the first time. As, during my isolated travels, I had not even read about the new light; my first impression really was that it was arc lighting, supplied with a tiny globe to soften the glare, after the style of the chic little globes (no bigger than an orange) which for several years have been used on many arc lights in Paris. But I soon learned the truth. Then, as I was getting back to civilization, I began to read up about it in the technical press. Very few Western technical journals have any circulation of repute in the Eastern world, although it is a fact that, in the Orient, I did see your JOURNAL in one of the commercial reading rooms. In Tokyo (Japan) there is the Emporium Exchange reading room. In Hongkong (China) also an Emporium Exchange reading room, but having no connection with the former.

The Russians took kindly to the new incandescent gas light from the start. The improved light meant a new lease of life to gas. Those towns which contemplated the installation of expensive electric light plants, suddenly found a new use for the despised gas works, whose "relegation to limbo" anybody would hitherto predict. Here, for once, is an instance of gas ousting, not electricity, but the contemplated introduction of electricity.

When, in '89, at the Paris Exposition, I often inspected the very creditably displayed pavilion representing the gas industry, I as often observed to myself: This will probably be the last representative gas exhibit at a Paris Universal Exposition, or any other international exposition.

As an exposition illuminant, gas was at its zenith at the Paris '67 and '78 exhibitions. At the '78 show, however, electricity promised to be a formidable rival, and 11 years later, in '89, the current had completely elbowed out gas as the general illuminant of the exposition and grounds.

Now, however, with the advent of incandescent gas lighting, there is exceeding promise that the representative gas pavilion, or building, at the 1900 Exposition will house the best display of gas ever made at a mundane fair. The delicate little mantle has come timely to the rescue of gas, and merits well of the country—I mean, the companies. As an illuminant of the buildings and grounds, incandescent gas is pretty certain not to be given the chance which it might have. Prejudice, and "it's old"—that is, the gas—will have much to do with this ignoring of the mantle, and its soft and steady, lunar-like illumination, as a factor of lighting at the coming *Universelle*. Then, again, the constant vibration of heavy machinery, the fine dust rising, the tramp tramp-tramp of millions of visitors—all these will cause a tremor and inconvenience to pervade the exposition buildings which might make the fragile mantles very short lived—although I know that with proper protection and handling, they should last longer than the Exposition.

Wanted—An Indestructible Mantle.—But I shall not be surprised if, ere the new century is out of the embryonic stage, some genius will make (as it will be called) an indestructible mantle—that is, one which will stand as much handling and defy as much shaking as the glass chimney itself. There will be a fortune in the invention, or, may be, litigation and poverty. Still, the gas industry, aided by the present mantle, will have a big showing at the Paris Exposition. The little incinerated textile hood will do good missionary work in the peaceful "battle of the incandescents"; and gas people will once more see a return to what they may call "the good old times."

Gas Progress in Russia.—But to return to gas in Russia. No sooner was gas in Russia given a new impetus by the mantle, than the brilliant idea occurred to some of the never over-active native heads of gas works, that they might improve matters more by trying to help themselves. "God helps those who help themselves"—so He does gas people. They set to work to familiarize the people in towns with the facilities of cooking and heating by gas; stocked quantities of cooking and heating stoves à la gas—opened, in fact, a sort of special stove and-hardware department, and sent out descriptive, illustrated booklets and price lists. The convenience and advantages of cooking by gas instead of charcoal were duly set forth; and with the cooking done thereby, the traveler has no fault to find when hungry—but the Russian gas stove heating! Their faulty stoves fill a room with invisible but olfactive fumes nearly as bad as those emitted from a worn-out old kerosene heater.

Then the prepayment meters were introduced, which brought in more kopeks than the Russian *chelofek* would ever have cared to pay in a lump sum.

Even the Russian camofap (samovar) of the tea-table—one of the minor glories of Russia—now has gas-heating attachment in the bigger cities. Tea as served in America is almost as tepid ditchwater compared with Russian-made tea.

The introduction of the asafetidous, garlic acetylene gas in Russia has been confined to outdoor purposes. Some companies of strolling players use it at country fairs.

Wages in Russian gas works are at the lowest ebb in Europe. Few hands make above 40 roubles a month ($20). The cost of living—and almost a dog's life at that—is double what it is in America or Britain or France; so the Russian operative exists rather than lives. He works 60 to 70 hours per week. Competent gas fitters in towns make no more than equal to $20 or $25 a month.

Concluding Remarks.—In a future letter I will someday—when finding the convenience and disposition to write it—say something about gas prices and conditions and machinery in Russia, with customs peculiar to the calling in a military-bureaucratic autocratism. For the present, I will conclude by saying that most towns in Russia proper having, since many years, their own gas works, there is less chance now than ever, due to the introduction of incandescent gas-lighting, of electricity proving a formidable rival to gas in the slow-to-change communities of Russia.

[From *Engineering*.—Continued from page 166.]

American Competition.—No. XVIII.

By MR. SPENCER MILLER, Engineer, New York.

Business depression in America, coincident with English prosperity, will invariably lead to America receiving the overflow orders from English shops. This may be successful competition from one standpoint, but it is hardly to be considered in the light of a great achievement. England is now prosperous, its shops are busy, and while in individual cases American goods have affected the English market, the English have quickly adjusted themselves to the situation, or found something else for their workmen to do, so that England as a whole can hardly be suffering from American competition; in fact it is quite possible that England profits by American competition.

The English locomotive builder certainly does not suffer from American competition, when with work to keep his shops busy for two years he finds a few stray orders booked in America., and, again, the railroad buying the American locomotive profits by the circumstance, because of time saved, if for no other reason. An American tool shipped to England may mean a loss to one English tool maker, but England profits by its use. With American shops filled with American orders, there will be little disposition to compete for foreign trade.

"Necessity" coupled with "Ambition" has played an important part in the development of American industries.

The early English settlers immigrating to America found themselves on the coast of New England face to face with a rigorous climate and the "necessity" for self preservation. New England so settled produces the largest percentage of successful inventors. Had the same people located on the coast of Florida there would have been no such "necessity," the climate would have dulled their ambition. The very hardships and climatic conditions faced by the New England settlers on that coast, whetted the inventive talent which produced great results.

The world is progressing, nations are using machines and mechanical contrivances more and more; railroads are being built, shops are being constructed, mines and canals excavated and farms opened all over the world at so rapid a pace that the shops of England are not capable of taking care of the extra volume of manufactured goods required, and it must share with America a large amount of the orders for machinery and manufactured goods which such rapid development demands.

Wherever "necessity" exists in a keen enough degree, there will shortly follow an invention of a machine or method, which will overcome the difficulty. This is as true of England as it is of America. The writer believes, however, that "ambition" plays a greater part in

America than it does in England. When the Americans see their Presidents rising from the ranks of labor, it properly stimulates their ambition.

American tariff laws have been a powerful stimulant for that home competition, which has resulted, much to the surprise of many manufacturers, in finding themselves with their products so raised in quality or lowered in price, that they are able to compete with foreign trade. The competition between manufacturers in America has been very sharp, and a battle where the fittest only survive.

Another powerful factor in the success of American shops is the excellence of the United States Patent Laws, which are unquestionably far in advance of those of any other nation. The United States patent for a device or contrivance, bears upon its face what it pretends to be. The claims are only as broad as the state of the art warrants.

It is a singular fact, but nevertheless true, that the United States Patent Office, in spite of the fact that it gives to its subjects protection as cheap as any other country, is at the same time a source of profit to the Government.

It so thoroughly examines each and every application filed, that an American inventor may learn more facts about similar contrivances to his own than would be possible in England by the payment of five times the cost of an American patent.

The British might well learn from the United States how to amend her patent laws. If England would place in its Patent Office a corps of examiners that would, as soon as a patent is filed, notify the inventor of conflicting devices, the manufacturer, before his capital is invested, would know in what degree his protection was available. While it is true that an American patent is frequently found to be ineffective, a skilful patent lawyer who reads the claims granted by the American Patent Office can usually predict such cases.

Wherever America has successfully competed with England, it has doubtless been at the expense of many a physical constitution wrecked and many a dollar lost. The American is reckless and a spendthrift of his strength; he works too hard and too long. A few become rich.

England needs no suggestion as to how to overcome American competition. Whenever the "necessity" to do so really presents itself, England will be equal to the emergency. The "necessity" which was America's, then becomes England's.

No. XIX.

By Mr. J. Keep, Superintendent, the Michigan Stove Company, Detroit, Mich.

In stoves, as in any other article produced from iron or steel in this country, it is a well known fact that no other country in the world produces articles finished to such a high degree of excellence as those made in the United States. The main reason for this is that our goods are finished by high priced workmen who take a pride in turning out goods that will be a credit to their shops, and furthermore, the systems of inspection prevailing in American factories are so rigid that imperfect work is rarely allowed to pass.

Owing to the rapid increase in population, the home market for American stoves is enormous, and little effort has been made to demonstrate to people outside America that they are superior to all others in operation, economy and appearance.

Orders from abroad come unsolicited, and large quantities are shipped, showing that we can control the stove trade of many countries if we make an effort to do so. The explanation of this seems to be as follows:

American stove making is a distinct business, and of immense proportions. Diversity of climate, and the cold winters in many parts of the country, make the question of heating appliances a very important one. There are more than 300 stove foundries in the United States, of which the Michigan Stove Company is the largest. This Company melts about 70 tons of iron daily, and completes about 350 stoves per day of its different varieties. The aggregate of its year's sales is over $1,500,000, and is yearly increasing. New styles of stoves are made each year, and old styles are abandoned, making the annual expenditure for patterns from $30,000 to $50,000. An American manufacturer does not wait for a pattern to become antiquated, but makes new designs as soon as his stoves are imitated by other makers, which causes very sharp competition.

Perfect Operation of American Stoves.—When this country was first settled, baking was done in brick ovens; the walls were heated by a wood fire placed inside the oven. When the ashes and coals were removed, and the oven filled, baking was perfectly uniform on bottom, top, and sides. An American cooking stove or range works as evenly as a brick oven and has no complicated dampers, therefore it requires no skill to operate it. Our heating stoves burn bituminous coal slack, with no smoke, and are very economical, and have no dampers, and need no attention. Our hard coal constructions are acknowledged all over the world to be the most desirable and satisfactory stoves made.

Character of Mechanics.—There are employed in an American stove manufactory, 12 distinct trades, each having a distinct department, and all workmen are of the highest order of mechanics, who seem to be as much interested in the success of the company as are its officers. Nearly all work is done by the piece, and the quickness of each man, and the absence of unnecessary motions, astonishes those who visit us from abroad.

Cost of Stoves.—Although the average pay of American mechanics employed in making stoves will average from $2.75 to $4 per day, yet on account of labor-saving machinery and dexterity of the men the cost of stoves, considering the quality, is such that they can be placed in any country and compete with the home product.

Inspection.—Each detail must pass an inspector; this insures the highest perfection; if anything escapes one department it will be detected by the inspector of the next.

Weight.—The strength of stoves to withstand heat and transportation does not depend upon the thickness of the castings, but upon the proper distribution of the metal. The scientific construction of patterns produces the maximum strength with the minimum weight.

Quality of Iron.—The strength and lasting quality of American stoves results largely from the peculiar adaptability of certain brands of American pig iron, which are used for stove castings and which makes them both tough and soft. In this country vast deposits of coal and ore occur in the same hills from which pig iron is made, which is best suited for stoves, and which can be produced at a lower price than elsewhere. The largest makers of stoves keep the quality of the iron perfectly uniform by mechanical analysis—the only practical method. This is now used by a large number of English founders of light castings used for spinning machinery; Messrs. Hutchinson, Hollingsworth & Company, of Dobbs Cross, England, were the first to adopt it, and others have followed their example.

What are American Stoves?—Some 20 years ago a Scotch firm purchased a number of stoves from the United States which seemed to them to be adapted to export trade, and used them for patterns to cast stoves from, advertising them as American stoves. The stoves, in the first place, were not salable here, and within a very short time were entirely out of market. "American" self-feeding hard coal stoves now made in Germany, using our stoves to cast from, are stoves which went out of market before 1880, but they are to day advertised as American stoves, and are even cast with "Detroit, Mich.," on them; they are represented as imported from the United States. Many will think of these stoves when I speak of American stoves. An American stove is up-to-date in every respect, with a modern and pleasing design. On an average an entirely new design appears about every three years. The castings are very smooth and perfect on account of the high grade of the iron and the superior quality of moulding sand used.

Popularity of American Stoves Abroad.—Canadian manufacturers have contracts with manufacturers in the United States to take duplicate patterns of all of their new stoves as fast as completed, to be used as patterns to make stoves from; but they have never taken a single set of patterns made in any other country. American stoves have been used as patterns in Scotland and in Germany; but there has never been a case where a manufacturer in the United States has used, or has imitated, a stove or range made in any other country. A good thing will be imitated.

Freight Rates.—Under the present prevailing conditions, goods can be freighted about as cheaply from New York, to almost any foreign market, as they can from Liverpool or London. From our lack of banking facilities, all American exporters are obliged to pay the English bankers a profit of from ½ to 1 per cent. Still, this charge does not cut much figure in the general result. Owing to the proximity of coal and iron fields, and the vast supply, we are able to produce goods made from iron and steel as cheaply, when quality is taken into account, as any nation on the face of the globe. The high wages we pay are off-set by the prices at which we can purchase our raw material, and the appliances which we use to facilitate production. When one reflects that we have been able to export to Great Britain and Europe all kinds of iron and steel materials, from pig iron up to axes and door locks, it will be seen that our position in point of cheap manufacturing is unsurpassed by that of any other manufacturing nation, and that in normal times we can beat the world in our prices, the same as we do in the quality and finish of our goods.

Address of the President (Mr. Henry L. Doherty, of Madison, Wis.), of the Northwestern Electrical Association on the Occasion of Its Eighth Annual Convention.

The year just closed has been one of remarkable activity and prosperity, and even under the most adverse conditions the resultant benefits cannot be entirely dissipated for some time to come. The central station business is dependent on the *general* prosperity of the community; although both good and bad results seem to lag behind prosperity and adversity in other channels. Average reports indicate a great increase in income and also a marked increase in cost of materials; but the increased business gained at this time will continue with us, even after the market for materials has again reached its equilibrium.

In spite of expressions to the contrary, all classes seem to be much more prosperous than heretofore; and the frequent statement that "the rich are growing richer and the poor are growing poorer" remains to be proven. If those who composed the poor population of a few years ago are canvassed to-day, there can be no question but their general condition has greatly improved, and amongst them will be found many of our rich men of to-day. Conditions which enable a man of fair ability to progress from poverty to wealth cannot be wholly bad, and radical changes under the guise of reforms should be carefully considered before being acted upon. I am often forced to believe that the frequent complaints are prompted by jealousy rather than adversity.

A semi-public corporation is more greatly influenced than other industries by the welfare of the masses. Imagine the effect on your business if every workable person had steady employment at good wages By good wages I mean a sufficient amount to enable them to have a comfortable home with modern conveniences. Sooner or later all will recognize that a high standard of wages is the only road to universal prosperity. High wages will not result from strikes, only so far as popular opinion will carry them; and I know of no quicker way to enlist popular opinion against the working class than by the so-called successful strikes. Proper expressions from the press, platform and pulpit, creating a universal interest in a higher standard of wages, thus inspiring the employers of labor to a pride in the condition of their employees, would do more to bring about this desired result than anything else I can imagine.

The formation of the so called "trusts" makes it possible for the working man's condition to be greatly bettered. Prior to their formation, wages could only be materially increased by a universal agreement. Now, in many instances, competition is almost eliminated, and many of the high officials have come up from the working class themselves, and might do much to better the condition of their former class Unfortunately, the men who rise from the working class have less generosity or fairness than the bondholder. If the condition of the workmen employed by these particular trusts is not bettered, the officers—not the stockholders—are open to severe criticism.

The progress made in steam and electrical appliances has been all that could be reasonably expected, even though not all that might be desired. The most substantial progress in all lines has been towards the improvement of former developments by the lessons of experience and better mechanical work. The steam turbine has been Americanized and bids fair to supersede, in a great measure, our present engines Experimental work has indicated a marked economy of steam consumption with other desirable advantages. American built high-speed engines, capable of being directly coupled to arc dynamos, are in successful operation, and steam economy equals most modern multi-expansion engines. The older types of engines have nearly all been greatly improved in detail; and there is a constant tendency for smoother running and better regulation. The exploitation of the electrical business has done much toward the development of steam practice. While there have been no marked improvements—except, possibly, for the steam turbine and the higher speed engines—the general operating results have been materially bettered.

The constant current transformer is here to stay, and street illumination by series alternating enclosed arc lamps seems to be a decided improvement over the old series continuous current open arc. The distribution of light is very materially improved, and the serious objection to the old open arc, of lack of uniform illumination, has been partially obviated.

Gas engines are now being built with satisfactory regulation and of any desired size. Two central stations, to the writer's knowledge, have adopted them as prime movers, and have selected sizes as high as 650 B. H. P.

Aluminum wire is already in satisfactory use as a substitute for copper conductors, and in view of the inflated price of copper, it would seem advisable to use aluminum as much as possible, to assist in bringing the price of copper to a more reasonable figure.

The use of exhaust steam for heating neighboring buildings, either by its direct transmission or by the circulation of hot water, is being adopted by numerous plants. The Programme Committee has provided for a careful consideration of this matter, so I shall not dwell longer on this subject, although one of great importance.

The distance and high voltage limit of transmission is being constantly increased, and one of the recent plants exploited will transmit current for an extreme distance of 155 miles at 60,000 volts. Two installations will be made during the coming year, of 25,000 volt cables underground.

The manufacture of producer gas is capable of further development and economy, and even under present conditions, producer gas and gas engines will yield a unit of energy for the least consumption of fuel. This field deserves the serious attention of engineers. It has a special value to central stations and other power plants with an irregular load. The best steam engines are only economical between certain ranges of loads, and are generally very uneconomical on light loads. The average boiler and furnace of an electric light plant works at a high efficiency only during a fractional portion of a day. Economy cannot be maintained on a boiler plant except that the grate surface be worked at practically a constant favorable capacity. As the load falls off, the flame temperature diminishes, which of itself is disadvantageous, and is apt to be accompanied by great over-ventilation of the fire.

A producer gas furnace—barring radiation—has about the same efficiency at all loads, and gas can be stored, while the storage of steam is almost impossible, and the storage of electrical current is not always practical or economical.

The necessity of a better distribution of street lighting is fast becoming apparent, and the incandescent lamp may yet prove a formidable rival in this field. I know of no city where it has been given a fair trial. A better knowledge is needed of the photometric value of arc lighting, and a committee has been appointed for this investigation by the National Electric Light Association, and some interesting developments may be expected.

The central station business is capable of greater development than is generally appreciated by the fraternity. Some cities have installed more than one incandescent lamp for each inhabitant, while others have less than one fifth of a lamp per inhabitant. Our expenses are made up largely of fixed charges, which are not greatly influenced by the volume of business done, and the larger the volume, the lower will be our k. w. cost at the lamp, and the larger will be our net profits.

Some business is not desirable, but with our present system of rates we are unable to distinguish between desirable and undesirable business. The direct current stations, by virtue of the limitations of this system, have been compelled to confine their efforts to the more profitable class of business, while the alternating current stations have often lost enough money on a certain proportion of their patronage to make the entire investment a loss instead of a profit.

There has been little improvement in the direct current methods in the past few years, but the most marked improvement has been made in the alternating current appliances and methods. "Unaccounted-for current" in alternating current stations has often amounted to 80 per cent. of the output, and 60 per cent. is more nearly the average than the extreme. Modern transformers, up to date methods and equitable rates should reduce the "unaccounted-for current" to an almost negligible amount.

The average central station is handicapped for the following reasons: First. Improper and insufficient education of operators; second, poor accounting; third, lack of capital; fourth, inequitable rates.

The ultimatum of perfection in central station operation requires education in all branches of engineering, accounting and business methods. Good judgment and diplomacy are such necessary attributes that their mention here would be superfluous.

Unfortunately the American people are too easily influenced by the statements of well known men, and read and accept their views without stopping to consider whether they are competent to know whereof they speak. Two well known financiers have, during the past year, stated that the young man of to day is over-educated; and we now hear much about so called super-education. I think this idea has taken greater root amongst central station men than any others. All of us cannot follow the vocation of financiering; and what special knowledge do these financiers possess of the needs of other vocations not known to others? Financiering is a profession—if it can be dignified by that

term—requiring the same talent as required by a pawnbroker or a country storekeeper, and the testimony of a man with a reputation only as a successful financier should be no more quickly accepted on the merits of education, than on the technique of piano playing. These men unconsciously aim to tear down all higher education for the sake of airing an unstudied whim.

Education, in its broadest meaning, cannot curtail a man's ability; and, if modern education proves harmful, it merely renders present methods questionable, and, in turn, indicates lack of proper education in psychology, pedagogy and kindred sciences on the part of our educators. Public men occupy positions of great responsibility, and the expression of ill-considered ideas is a worse sin than simple indiscretion. True, higher education is the factor which promises to make the American nation supreme, and opposition to education in general dismantles the vehicle of progress.

Perfection in the electrical business will never be made by following the advice of these accepted oracles, and placing ignorant men in positions of responsibility. Select your employees with the usual requisites as to knowledge, truthfulness and judgment; but, by all means, when these talents are equal, choose the most highly educated talent the position will command. I would also recommend further education of present employees. Many correspondence schools are springing up all over the country, and I know some of them are good. The promoters of this method of education are doing a great philanthropic work. They may be unconscious of it, and are, undoubtedly, prompted by personal gain; but, nevertheless, correspondence schools bid fair to do much towards our progress, and have many advantages peculiar to themselves. They reach the man who *wants* an education, and the man who knows *what kind* of an education he wants. They reach the man who is probably engaged in the very work he is studying, and his education and practical experience go on simultaneously, and his work is apt to keep him interested in his studies. They place within the reach of all the means to take advantage of the opportunities that are apparent to them.

If the accounting for central stations was intelligently and carefully done, and each item of the total expenses could be determined and compared with previous periods or results in other plants, I am inclined to think that the benefit would amount to more in the profit and loss account than the knowledge of how to construct dynamos with an efficiency of 100 per cent. Perfect superintendence is only to be had when supplemented by intelligent accounting and record keeping, and the use of registering and recording instruments. Good scales, engine indicators, recording station wattmeters and consumers' house meters will enable daily determination of "boiler efficiency" and "combined engine and dynamo efficiency" and monthly determinations of "line, transformer and meter efficiencies." In many instances I would go even further than this, and recommend primary meters on every bank of transformers, and thus check the accuracy of consumers' meters by districts, and enjoy a better opportunity to protect the station from thefts of current.

Each separate item of cost should be accounted for separately, and items like fuel, labor, repairs, etc., should be determined per k.w. for monthly or other convenient periods, and compared with other similar periods, aiming, of course, to continually reduce such cost. Cost of reading meters and trimming arc lamps should be computed both on cost per k.w. sold, and also on basis of cost per meter and arc lamp installed.

So-called good bookkeepers and accountants are often nothing more than good copyists. A really good accountant must be able to determine and keep advantageous sub divisions of income and expenses that will enable comparisons to be made, which will permit the former to be increased and the latter decreased. The best results obtained may thus be used as a standard, and, unless constantly equalled or bettered, a satisfactory explanation may be required from the man in charge of that particular department.

The necessity for some equitable method of charges is of greater importance than the attention given this matter would lead one to believe. Flat rates for a steam plant are almost absurd, yet have some peculiarly redeeming features. Straight meter rates are so inequitable as to render one customer highly profitable and another customer absolutely unprofitable, both paying a uniform rate. Sliding scale meter rates are generally based on nothing, and merely represent the whim of the maker. The Wright demand meter and the General Electric Company's two-rate meter are steps in the right direction, but cannot be regarded as anything more than makeshifts. The plan of charging a certain rate for the complete installation for the first hour, and a lesser rate for each succeeding hour, is often more equitable than either, and is far more simple. All plans so far proposed are manifestly inequitable under some conditions. I had hoped to go into this subject more at length, but it is far too intricate a question for an address of this nature. I mention it at this time in the manner I do merely as a challenge to the advocates of all present systems, in hope of provoking a controversy which may lead to a good solution of the problem. I believe this matter worthy of being referred to a competent committee, and recommend that the Association do so.

The lack of capital is a serious disadvantage in many central station enterprises. The accounting is often of such a nature as to prejudice their credit. Many plants are using obsolete machinery, and are tied to past bad methods or former engineering errors that are costing them in operating expenses enough in every few years to put the plant in modern condition.

A few years ago capitalists had little or no confidence in the earning capacity of central stations. To-day, they are pretty well convinced of their earning ability; but they are afraid that all the electric plants are going to be absorbed by the municipalities, and capitalists generally are not sufficiently familiar with this business to be able to judge of its merits from an investment standpoint. A united and determined fight to educate the public on the fallacy of municipal ownership is desirable; and good accounting will also do much to heighten the credit of the central station business. Good and *uniform* accounting would do much more towards accomplishing this end.

The agitation about municipal ownership seems to be as active as ever; and, to be frank, I think it is increasing rather than diminishing. Without commenting on the motives of many of the leaders, it must be admitted that others of them are sincere and honest in their advocacy of this cause. If this craze is allowed to run its course, popular opinion will, in time, desert it; but in the meantime many of our properties will be injured, and the cities adopting it will reap a harvest of disappointment for their failure to give the matter proper consideration.

One of my political friends once wrote me as follows: "They (the people) want it, and I am on record as favoring it. I am no longer so sure I am right; but there are other reforms that I know I am right about. Were I to experience a change of heart on this question, it would remove all chances for my election and would elect my opponent, who knows less about this subject than I, and who has but this one plan in mind. Even should our electrical venture not prove thoroughly successful, I can manipulate other reforms that will more than compensate for this. No matter what my personal views may be, my election will make me their servant, and I can but do as 90 per cent. of the people want me to do. Even if I admit that most municipal electrical plants have been failures, it does not follow that ours will also be a failure. I think you will grant that it will be honestly run during my administration." There is a lesson for all of us in this letter. Here is a man that, to my personal knowledge, is as honest as the average man; in fact, even more so. To his mind 90 per cent. of the people want a municipal plant; and no sane man would express opposite views to 90 per cent. of the people and expect to receive an election at their hands. I fear we are wasting our breath in trying to educate the municipal officers. A majority of them already know that municipal ownership is a rank fallacy, but they are too wise to express views contrary to the people they must look to for re-election. By championing the views of the people—even though they know them to be wrong—offers an easy road to office. *We must educate the people.*

"You cannot fool all the people all the time," and more than one community has awakened to the fact that municipal ownership did not yield what was promised. *I challenge anyone to cite a single instance where a municipal plant cost no more than was anticipated and yielded all that was promised.*

I attended the convention of the League of American Municipalities by invitation from them, as the representative of the Northwestern Electrical Association and the National Electric Light Association. Other representatives and myself contended that municipal ownership had not been a success in the past, and we could not see how they could expect to make it a success in the future. We offered, on behalf of the National Electric Light Association, to bear half the cost of an investigation of 20 municipal electric plants, selected by the president of the League, to determine the true cost of service for comparison with the rates charged by private plants.

We made this offer in good faith, believing that an investigation would vindicate our position. I regret to state that the League failed to accept our proposition in a manner insuring its execution. Their acceptance on any terms was only secured by a great effort, and their final acceptance was promised conditional upon their ability to provide

funds, and as far as I know, they are making no effort to raise them. I would recommend, if they cannot otherwise be induced to make this effort, that our Association solicit subscriptions and notify them that if they will make an earnest effort to solicit funds amongst the advocates of municipal ownership, we will guarantee them enough more to make the necessary amount of $2,500. I promise $100 towards this subscription, and recommend that this matter be placed in the hands of a suitable committee.

The sentiment of the masses has been more roused against the semi-public corporations by a marked increase in the value of some of these properties than by any other cause. To attack this particular property and exempt other property, seems to me unjust. Let us for the moment admit that this class of property has appreciated by virtue of increased population and other benefits, not secured solely by the personal efforts of the owners and managers of this class of property, and endeavor to justly ascertain to whom this increased value should belong. This can most easily be done by comparison.

Let us assume that Smith and Jones seek investments in the same small town. Smith builds a street railway and electric light plant, and Jones buys real estate. Smith, by virtue of his class of investment, must employ labor and give assistance to other local enterprises, pay ing the most strict attention to his business, and do everything within his power to assist in the development of the town for the sake of developing his own property. Jones has a class of property which requires the employment of no labor, practically no attention, and merely the payment of nominal taxes. He need in no way assist in the development of the town, and his investment has added nothing to the physical property of the town, for the property was there and was just as available before his purchase as afterwards. He can live in Europe or elsewhere and feel perfectly secure of his investment.

In the course of a few years this small town has grown to be a big city. Smith finds his property has increased greatly in value. The real estate which Jones purchased has been surrounded by modern buildings, gas, water, electric light, sewers and improved streets, and has also increased greatly in value, each development having con tributed its share towards this increased valuation to Jones' property. He is now rich and influential. No one seems to be prejudiced against him or seeks to deprive him of what might be construed as unearned wealth. Smith, on the other hand, who has done much to assist in the development of the city, is regarded as a trespasser on the city streets; he is a target for abuse and hatred. The masses believe the increased valuation of his property should belong to them, and the city is urged to confiscate his property for the profit (?) of the city. To me it seems that Smith is even more entitled to the increased valuation of his property than is Jones, and I cannot feel that the American people can take any other view of this matter after the question has simmered down to a pure matter of fact, and politicians and newspapers treat the subject in this manner and discontinue their present method of oratorical gymnastics, which sound well but mean nothing.

I know of no property of semi-public corporations that has advanced in value to such a marked degree as some of the real estate in that same town. Did any of these people who continually harp on the free use of city streets ever stop to calculate how much we save the streets in wear and tear, and resultant noise and confusion, were the energy we deliver in the form of electrical current and gas to be transported over the streets in the form of solid material? Do they ever stop to think that street railway travel is more convenient and less than one-fifth as costly as the best known other means? Any other system of transportation would cause greater use and wear of streets to obtain the same service, which never could be so good.

Governmental and municipal ownership, if carried to their reasonable ultimatum, would include every form of industry, and the undesirable result of this is too apparent to call for comment. Unconsciously, or otherwise, the advocates of municipal ownership seek to thrust u on us a bad foreign policy, and the best examples they can cite are amongst those nations that are "traveling towards the night." We have enough municipally operated plants in this country from which to seek our examples; but these examples fail to strengthen the theory of these people, and they, therefore, seek examples in countries where workmen are practically serfs, and their rate of pay is such as to maintain them in an ignorant and dependent state.

America's greatness is not due to imitation or adaptations of foreign policies. Let us think and act for ourselves. Individualism has made us a great and prosperous nation; and, even if individualism is open to criticism, let us be sure that paternalism is better before it is adopted, even in the slightest degree.

Generally, all we ask is to be let alone; we should, however, enjoy better protection from thefts of current, and a permanent method of taxation should be decided upon. As a matter of justice, and for the sake of developing our natural resources, the companies developing water powers and transmitting at long distance, should be granted the right of eminent domain. Interference with high voltage transmission lines should be so severely punishable as to offer the most complete protection to these properties.

The development of water powers represents a field of great activity, and one highly profitable if backed by caution, good engineering and judgment. Hasty conclusions, bad engineering and improper decisions have and will bring disappointment. A water power is good for its minimum capacity only; and volumetric calculations on the flow of the stream cannot be too carefully made or gaugings taken for too long a period. Each development has its own particular difficulties, such as anchor ice, freshets, back water and suitable foundations, requiring not only intelligent engineering but experienced engineering.

The power thus secured is not always quickly salable, and unexpected extra costs have often run the fixed charges to a figure that, when added to the operating expenses, exceeded the cost of steam power. This has been the case particularly when the cost has been reduced on the basis of quantity sold. Many central stations have a maximum load peak 15 to 20 times the minimum load; and, if the cost of development per unit of power is high, the anticipated profits are never realized.

There is a most unjust freight classification on all electrical goods, and the National Electric Light Association has recently issued a pamphlet giving a very clear explanation of this matter, and the method we should pursue for relief. I hope each member will procure a copy of this pamphlet and use his personal influence to convince the railroad men of their acquaintance of the gross injustice of the present classification. I would also recommend that the incoming President take up this matter, and, if possible, provide assistance in the excellent work being done by the Committee of the National Electric Light Association.

The Northwestern Electrical Association is experiencing a substantial and healthy growth, and is capable of doing much valuable work for the benefit of the central station business. Every central station in the Northwest has and will be benefited to a greater extent than the cost of membership in this Association and the sending of a representative to all of our conventions.

While our membership is already large, there is no reason why it should not be trebled, and an organized and earnest effort should be made this coming year to induce all central stations within our territory to join the Association. When our representatives go before a legislative body or a traffic association, their influence is proportional to the membership they represent; and the larger our membership, the more apt we will be to accomplish whatever reforms are undertaken, and the greater will be our confidence in undertaking new and important work.

There are numerous other Associations, and I sincerely trust that at no distant date a strong effort will be made for a closer relationship between these various Associations, which will greatly increase the usefulness of all of them.

[From *Electricity*. Part IV.]

The Future of Electric Illumination.[1]

By Mr. Jean Wetmore.

In preceding articles we have briefly reviewed wires, insulation, conduit tubing and the effects of Underwriters' regulations toward producing an increased cost and the complexity of present electrical practice viewed from an independent vantage ground and in the light of future improvements.

We now consider light producers and find that the contest between electricity and gas to be more evenly balanced when all the advantages and disadvantages are considered.

The arc lamp, one of the most efficient and cheapest of electric light producers, must be fed by a heavy No. 6 wire of copper at 16½ cents per pound; its light rivals the sun for purity and penetration, but it finds its principal uses restricted to out-door work and in lighting large interiors, its machinery is expensive, and complicated to construct, with its main regulating coil, shunt cut-out, rods, levers, springs, cogs and clutches, heavy frame and supports and its ever consuming and constantly renewed carbons, that cost money from night to night; then come the repairs and fine adjustments, broken globes to renew and to keep clean.

All these items do not well compare in economy and attention with

1. *Ante*, p. 171.

the refractory mantles over Argand burners that are coming so plainly in evidence lately in street lighting.

For the smaller more diffused light we have the incandescent lamp, with its yellow, dim light in an often smoky glass bulb, containing often a barely red hot hair pin of fragile filament, of inconstant durability and constantly decreasing efficiency, trying hard to do its duty in an uncertain vacuum.

We cannot turn the light up brighter or down lower and save expense.

With this lamp as with the arc it is the whole thing or nothing—no intermediate graduations or house wifely economy.

How do these two classes of electric lamps compare with the brilliant white light of the lately improved refractory mantles, two for 20 cents that last a year, and a burner that is practically indestructible?

Then there are the improvements that are coming along, such as automatic lighters and no matches used; improved mantles that nearly double the amount of light with the same gas consumption; while we have no improvements in the incandescent glow lamps since the Westinghouse Company used a glass stopple to evade the Edison patents, a mere makeshift with no light producing increase.

Vacuum tubes have so far proved to be practical delusions, and the Nernst lamp has only given some erudite professors an opportunity to make themselves conspicuous by their learned dissertations.

We seem to be at the end of our string, and we are face to face with the fact that the gas men have been silently stealing a march on us.

What must we do to be saved? Where is the Moses to lead us out of the wilderness?

When the National Electric Light Convention was held in St. Louis several years ago, we saw glow lamps made to burn without wire connections; has it never occurred to any one to use copper threads and make the idea a tangible commercial fact?

Why confine ourselves to our present heavy amperages, and expensive conductors, to carry a current that will melt anything that it will not consume, and will take human life if one gets in the way of it, when there are other forms of electricity, that produce light and like the biblical burning bush, that burns and is yet not consumed.

We should convert our amperes that are so expensive to carry about into volts that do not have to be carried on or in anything, but would run around without any substantial props, the kind that have millions in them, that are beyond the jurisdiction of the Fire Underwriters, and are life givers and microbe killers, instead of human life takers and insulation requirers.

If properly utilized we have enough scientific facts about these highly attenuated forms of electricity chopped out by our non practical investigators and posers for notoriety in the Sunday editions of the sensational press, to make the gas people sore afraid, and cause them to be buried in commercial oblivion.

Our great investigators should not spend the hard earned increment of our gullible millionaires trying to send motive power to London or Paris by means of the Aurora Borealis from the summit of Pike's Peak, or fritter away their time teaching the inhabitants of Mars the English language, when we are in need of an electric light that requires no carbon consumption, no machinery, no vacuum surrounded by glass bulbs; but a lamp that produces a white, pure light, without heat, or air consumption, and does not require a copper rod as large as a marlin spike to feed it.

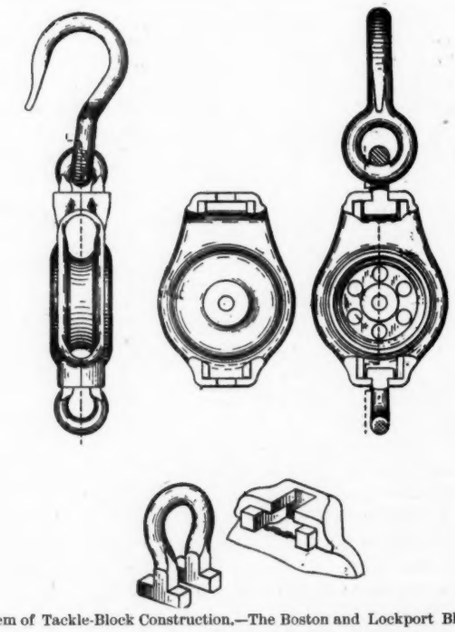
Do they not know that the price of copper has gone up, and that the gas trusts are making the electric men feel melancholy?

[To be Continued.]

A New Tackle-Block.

Engineering News describes a new tackle-block, which is the invention of Mr. A. B. Tarbox, of the Boston & Lockport Block Company, of Lockport, N. Y. The inventor's purposes were to simplify construction, decrease cost of manufacture, increase strength and diminish the wear on the rope used.

In this block the cheek pieces are either made by casting, or by striking-up sheet metal; and the parts are so formed and connected that they can be assembled in a perfect block without fitting or machine work of any kind. In the single block here shown the metal cheek pieces are provided at their upper and lower ends with lateral interlocking lugs and extensions, projecting inward, and thus form the shell of the sheave. The square shanks of the upper and lower shackles interlock with the interlocking cheek pieces in such manner that when any strain is put upon them the tendency is to draw the ends of the cheeks together. The patent drawings show various methods of arriving at the same results, and the use of sheet metal shells formed in dies. With a block having more than one sheave, center pieces are used having interlocking lateral projections connecting them firmly with each other and with the cheek pieces. In this case two upper shackles with square shanks are employed instead of one, so as to bring as much of the strain as is possible in line with the side pieces. In all cases the shell is securely held together by the sheave-pin, or axle.



A New System of Tackle-Block Construction.—The Boston and Lockport Block Company.

The Recovery of Nitrogen in Coal Distillation.[1]

[By W. Carrick Anderson, D.Sc., and James Roberts, F.C.S.]

After some introductory references to the advantages of gaseous fuel and the extent to which ammonia is now recovered, the authors proceed:

The importance of a thorough understanding of the conditions under which ammonia is obtained from coal is thus apparent. It is an importance which is not to be measured by present day results, successful in a way, and profitable as these undoubtedly are, but by the enormous future which lies before these industries when the doctrine of economic waste has been brought home as a vital truth to a larger section of the community than at present.

The points we propose specially to consider are:

(1.) The way in which the nitrogen of coal distributes itself on heating, and the conditions under which ammonia is obtained in retorts and ovens.

(2.) The limits of ammonia production, and the obstacles in the way of reaching these limits.

Nitrogen in Coal.—It is difficult to say exactly what the average nitrogen content of coal is. Samples differ so much within the narrow limits of, say, 1 to 2.5 per cent., that it is hardly possible to set down a single figure as the ascertained average. Excluding anthracites, however, from consideration, analyses we have made of specimens drawn from very various quarters seem to indicate 1.4 per cent. as not far removed from the average figure—1 ton of coal assaying 1.4 per cent. N contains 31.36 pounds N, equivalent to 147.8 pounds sulphate of ammonia. From figures quoted by Mr. Beilby, in his address to the Society last year, it appears that the average yield of sulphate of ammonia per ton of coal is:

From coke ovens...	19.7 pounds	= 13.3	per cent. of available (calculated on above basis).		
" blast furnaces	20.2	"	13.7	Do.	Do.	Do.
" gas works....	22.4	"	15.1	Do.	Do.	Do.

Overhead, the average weight of sulphate recovered per ton of coal is rather under 22 lbs.; or about 14½ per cent. of the available nitrogen is obtained in this form. The quantities of nitrogen recovered and recoverable as cyanogen compounds, while forming a fairly large aggregate, work out to such a small figure per ton that for the moment we leave them out of account.

1. From a paper read before the Scottish Section of the British Society of Chemical Industry.

Coals are mixtures of more or less complex bodies, produced from the degradation of the original constituents of the vegetable substances that went to form them; and one of these bodies at least in every coal is nitrogenous, derived from the primitive albuminous or protoplasmic substances of the plants and their spores. It is this body, or series of bodies, whose behavior on distillation we have to consider, and the first difficulty that meets us is our entire ignorance of its character and constitution. Tervet, however, has shown that when hydrogen is brought in contact with nitrogenous bodies at a high temperature, the latter part with their nitrogen more or less freely in the form of ammonia, and in the generality of cases the ultimate result is a complete, or almost complete, conversion of it into this form. The ease with which the separation is effected, however, varies in different compounds; pyrrol and alkaloids do not appear to be so susceptible to the action of hydrogen as other substances; paracyanogen, on the other hand, which initially contained no hydrogen, gives ammonia at once.

Behavior of the Nitrogen on Heating.—When coals are subjected to a gradually increasing temperature in a closed vessel a considerable loss in weight is experienced before the thermometer reaches 300° C. (W. Carrick Anderson) but in no case have we found any loss of nitrogen to take place under 333° C. Above that limit coals differ very widely as regards the temperature at which ammonia or other basic substances begin to be evolved. The exact determination of these minima directly in the case of different coals is rendered somewhat difficult by the varying duration of the acid reaction, which, in most cases, is noticeable in the distillation process at temperatures between 315° and 400° C. In every coal we have tried, however, the alkaline reaction may be said to start below 480° C. The splint and gas coals of Mid Lanarkshire begin to yield alkali at what is, comparatively speaking, a low temperature, a fact which has undoubtedly been of great value in relation to the development of ammonia recovery in the blast-furnaces of the West of Scotland. In the case of the strongly caking coals the minimum temperature of ammonia formation is higher than in the Lanarkshire splint and gas, but in all instances of which we have experience it lies below 470° and 480° C. The evolution of ammonia, when started, continues for a considerable length of time, during which the temperature of the charge is steadily rising, and even when a quantity of material has been at a red heat for some time, it is possible to detect an alkaline reaction in the gases.

The varying temperature at which the evolution of ammonia begins in the case of different samples of coal would suggest at once that the nitrogenous bodies present in them were different. This conclusion is supported by other evidence as well. For example, the derivatives we have obtained by oxidation of the coals are apparently different, and in other ways the nitrogenous constituents in different coals behave differently.

Nitrogen Remaining Fixed in Coke.—While this is so, it is an interesting fact that the fixed residues of coals which differ widely in character, and which come from distant localities, contain a very constant proportion of nitrogen, when the residues are prepared in the same way, under identical conditions. In a series of experiments we conducted with reference to this point, two grammes of the finely powdered coal was heated in a covered platinum crucible for exactly two minutes over a strong bunsen burner, and then, without cooling, for exactly three minutes over the foot blow pipe. The cooled residues were weighed, and after being finely ground, the nitrogen was determined in one gramme of the powder.

Table I.

Name of Coal.	Nitrogen in Coal.	Weight of Fixed Residue (Coke).	Nitrogen in Fixed Residue (Coke).	Nitrogen Expelled from 100 grms. Coal.	Nitrogen Left in Coke from 100 grms. Coal.	Per Cent. of Original Nitrogen Left in Coke.
	Per Cent.	Per Cent.	Per Cent.	Grms.	Grms.	Per Cent.
1. Ell coal	1 53	55.37	1.83	0 517	1.013	66 2
2. Splint coal	1.50	55.14	1.73	0.527	0 973	64 9
3. Kiltongue Coal	1 65	55 84	1.77	0 661	0 989	59 9
4. Bannockburn Main coal	1.89	69 93	1.80	0.631	1 259	66 6
5. Kilsyth coking coal	2.04	66 59	1.79	0.849	1 191	58.4
6. Lower Drumgray (Slamannan)	2.12	79.14	1.79	0.693	1 427	67.3

1, 2, and 3 are non-caking bituminous coals, 4 and 5 are well known caking varieties, while 6 is from a seam which has been partly "burnt" by intrusive volcanic rock, converting it into a high-class steam coal. The numbers given in our third column of figures are strikingly large as compared with those that are recorded for certain samples of coke made on a manufacturing scale (Foster and Watson Smith). An explanation of the difference at once suggests itself as likely to be found in the fact that very much more rapid heating has taken place in the case of the small sample treated in a platinum crucible than is possible with a charge of 4½ to 5 tons in a coke oven, or even with one of 3 cwts. in a gas retort.

From the experiments of Tervet, quoted above, the nitrogen of coal is capable of being eliminated completely, or almost so, by the action of hydrogen at a red heat. Time, however, is a necessary factor in the reaction, and in the experiments detailed above the influence of the hydrogen ceased completely in less than five minutes, whereas, even in the comparatively rapid process of heating employed for making illuminating gas, a hydrogen atmosphere surrounds and permeates the coal, before it is thoroughly cooked, for a much longer period. Much more is this the case in the coke oven, and especially in wide ovens of the beehive type, where a temperature of 350° C. and upwards, sufficient to cause formation and evolution of ammonia, may, and even must, exist for a very long time, especially in the central region, before the heat required for complete coking has penetrated from the top or sides.

The figures given in the third column of Table I. show a very striking agreement among the percentages of nitrogen left behind in the fixed residues got on ignition; yet it would not be safe to lay too much stress upon such apparent identities. Although the figures representing nitrogen expelled show a little more variation, they are really of greater practical and even theoretical importance.

Since the nitrogen is expelled through the agency of hydrogen, it might be hastily assumed that the absolute amount thus volatilized ought to bear some approximately constant ratio to the total hydrogen or to the amount of, so called, available or disposable hydrogen in the coal, or even to the amount of volatile matter obtained on ignition. In point of fact, it shows no such relation. And on further consideration it is obvious that we have no real ground for any such expectation. To begin with, even if the composition of the gases from two coals were absolutely identical, the temperature of decomposition in the one case may be very much higher than in the other, and the influence of equal weights of hydrogen on the contained nitrogen will therefore not be the same. Moreover, a "coal" is a complex mixture, and the total hydrogen in one may be made up from sources whose relative values are different from what they are in another sample. The "disposable" hydrogen and even the so called "combined" hydrogen may be disposed differently, and the volatile matter may be of a very different composition in different cases. Take what is known as "isomerism" in coals. Here are two samples:

Table II.

	Gas Coal (Hamilton District.)	Upper Drumgray Coal, Sample (1) (Airdrie District.)
H	6.11 per cent.	6.16 per cent.
C	83.92 "	83.69 "
O + Org.S	8.29 "	8.36 "
N	1.68 "	1.79 "
	100.00 "	100.00 "

The figures for the ultimate analysis are practically identical, but in every other respect the coals are different. The one is the Hamilton gas coal, a non-caking, shaly-looking mineral, with a marked conchoidal fracture, giving, on distillation, a large yield of gas. The other is a bright, lustrous substance, with irregular fracture and of fair caking power. But when ignited the one gives 2 per cent. more volatile matter than the other, and we can safely affirm that the temperatures at which decomposition will begin, and the form in which the volatile matter will appear under similar conditions of distillation, will not be the same. Hence the action of the hydrogen on the nitrogen contained in the two bodies must necessarily be different, to some extent, in degree; and, indeed, the gases evolved in the one instance begin to give an alkaline reaction at a temperature 40° lower than in the other. Our former investigations on the derivatives of the nitrogenous constituents of coals seemed to indicate that in different coals we had to deal with bodies which, although similar, were not absolutely identical in composition, and the position and arrangement of the nitrogen atoms in the original bodies may therefore be assumed to be different.

One other observation we have made in this connection is important. The samples of coal in which the above determinations of nitrogen, fixed and volatilized on ignition, had been made were left in a finely powdered condition in bottles for a period of ten months, and similar

determinations were then made upon them. As the result presumably of an alteration in the composition of the coals consequent on atmospheric oxidation, the distribution of the nitrogen on ignition had changed. In both the samples of caking coal it was found that a much larger percentage of nitrogen remained fixed in the coke, in the splint coals the amount was the same, while in the Kiltongue it was less than at first.

Table III.

	Nitrogen (at first). Per Cent.	Nitrogen (after Coal had lain powdered for Ten Months). Per Cent.
Coke from splint coal contained.....	1.73	1.720
Coke from Kiltongue coal contained.....	1.77	1.575
Coke from Bannockburn Main coal contained.	1.80	2.100
Coke from Kilsyth coking coal contained.....	1.79	2.244

A 5 gramme sample of the splint coal which was found to show the least amount of change in these experiments was boiled for 60 hours with 300 c.c. of a 5 per cent. solution of sulphuric acid. The residue was thoroughly washed till free from acid (an operation that required a very long time), then dried at 100° C., and examined. The composition of the sample, as indicated by proximate analysis, remained practically unchanged.

Table IV.

	Original Coal. Per Cent.	Treated Coal (Dried at 100° C.) Per Cent.	= Calculated on Basis of 7.27 per Cent. Moisture. Per Cent.
Moisture.....	7.27	0.60	7 27
Ash.....	2 20	1 42	1.32
Volatile matter.....	46.22	39 94	37 26
Fixed carbon.....	54.31	58.04	54.15
	100 00	100 00	100.00

When, however, the fixed residue got on ignition of this sample was assayed for nitrogen, it was found to contain 2 per cent., as compared with 1.73 per cent. in the original coal.

The conclusion we arrive at is, that in ordinary practice of ammonia recovery in distillation, the first factor to be considered is the character of the coal itself, and that, even when distilled under identical conditions, different coals will give off variable amounts of nitrogen, and that this is not dependent altogether on the quantities of nitrogen and hydrogen, or of both, which the coals contain.

Effect of Reagents on the Fixed Nitrogen.—The portion of the original nitrogen of the coal which becomes fixed in the carbonaceous residue (amounting in our experiments—Table 1—to 53 to 63 per cent of the total) is at the present time unrecovered in any of the industries which deal with the manufacture of nitrogenous compounds from coal. Its presence in the coke, moreover, necessarily lowers the heating power of the latter, and in the blast furnace diminishes the efficiency of the active gases generated in its combustion, by diluting them with a more or less considerable proportion of free nitrogen. In these circumstances it seemed worth while to try the effect of certain reagents in eliminating this nitrogen; and the results are interesting, even if they do not offer very much encouragement. The splint and ell coals were selected as examples of the non caking class, and Bannockburn Main and Kilsyth coking as typical caking coals.

(*a*) One gramme of the sample, in powder, was thoroughly mixed with 5 c.c. of a 10 per cent. solution of caustic soda (=0.5 gramme NaOH) in a platinum crucible. The mixture was then evaporated to complete dryness, and the residue ignited under exactly the same conditions as described above. A determination of the total nitrogen in the residue was then made. (*b*) One gramme of the sample was mixed with 10 c.c. of milk of lime, containing 0 5 gramme CaO, and the mixture evaporated to dryness and coked as before. (*c*) 0.66 gramme Na_2CO_3 (=0.5 gramme NaOH) was substituted for the caustic soda in the first set of experiments. The results obtained are shown in Table V.

The residue from 1 gramme splint, which had been treated with a mixture of 0.5 gramme Na_2CO_3 in solution, and 0.5 gramme $Ca(OH)_2$, contained 0.0115 grammes nitrogen = 76.7 per cent. of the original nitrogen in the coal.

These figures present two very remarkable features: (1) a fairly complete elimination of the fixed nitrogen is effected by caustic soda in the case of the non-caking coals, but none at all in the caking varieties; (2) carbonate of soda causes, in every case, a further fixation of nitrogen, and in the non-caking coals this is equal to over 90 per cent. of the total nitrogen content of the coal; (3) slaked lime produced in all cases very little result, but invariably showed a tendency towards fixing additional nitrogen in the coke. Blank experiments had proved the absence of any estimable quantities of nitrogen in the regents used.

Whatever amount of stress we are to lay upon these results, they establish at least a distinct difference between the nitrogenous bodies in the caking and non-coking coals in one particular, namely, their behavior towards caustic soda at a red heat. But to what is the marked difference of the action of sodium hydrate and sodium carbonate to be ascribed, and at what stage in the heating process does the liberation of the nitrogen by the former reagent take place? To throw some light on this point, 1 gramme of splint was fused for 45 minutes with 10 grammes of caustic potash in a silver basin at a temperature just sufficient to keep the mixture liquid. After cooling the mass, it was found to contain 0.0148 gramme of nitrogen (N in original coal = 0.0150 gramme), so that at that temperature, even prolonged contact with fused alkali had failed to convert any appreciable part of the nitrogen into volatile compounds.

Ignition with excess of sodium carbonate had shown in every case a fixation of the nitrogen which would have been set at liberty under ordinary conditions; in the case of the caking coals caustic soda produced a like result. The question suggested itself, Is the extra nitrogen thus fixed in the form of soluble or insoluble compounds? To ascertain this, 1 gramme of splint was treated as before with soda carbonate, and ignited. The residue was then completely extracted with hot water, washed and dried. The dry extracted residues still contained 0.0095 gramme of nitrogen—*i. e.*, the same quantity as it was found to hold when ignited in the ordinary way. The filtrate from the insoluble residue contained sodium cyanide equivalent to 0.0022 gramme of nitrogen, and a small quantity of sulphocyanide which was not determined.

(To be Concluded.)

Metallic Derivatives of Acetylene.

Berthelot and Delépine, in *Comptes Rendus*, assert that Berthelot's theory is confirmed that acetylene and carbides of the formula C_2M_2 may be compared with ammonia and nitrides, whilst carbide derivatives $[(C_2M_2)R]$ correspond to ammonium salts. The carbides of hydrogen, silver, sodium, and probably potassium, are endothermic, whilst those of lithium and calcium are exothermic. Mono-potassium carbide (C_2HK) and mono-sodium carbide (C_2HNa) are known, and probably a similar silver salt exists, though it has not yet been isolated. As might be anticipated from the amount of heat absorbed in their formation, these bimetallic compounds are less stable than the others.

According to Berthelot, acetylene may be compared with many simple acids in the gaseous condition, and notably with hydrogen sulphide as regards the substitution of its hydrogen by metals. The following table shows the amount of heat in calories liberated by the substitution of sodium or silver for the hydrogen in the gaseous acids and in acetylene, the metallic compound being in the solid state:

	H_2 by Na_2.	H_2 by Ag_2.
2HCl	+ 151.8	+ 14.0
2HBr.....	+ 155 0	+ 29.6
2HI.....	+ 150.0	+ 41.2
2HF	+ 144.4	— 20.6
2HCN	+ 106 2	— 7.0
H_2S.....	+ 84 5	+ 1 2
$2(NO_3)H$.....	+ 152.6	— 11.4
C_2H_2.....	+ 49.3	— 29.05

Table V.

Name of Coal.	Nitrogen in Coal used Grms.	Nitrogen in Coke from untreated Coal. Grms.	Percentage of original Nitrogen in Coke. Per Cent.	Nitrogen in NaOH Coke. Grms.	Percentage of original Nitrogen in NaOH Coke. Per Cent.	Nitrogen in $Ca(OH)_2$ Coke. Grms.	Percentage of original Nitrogen in $Ca(OH)_2$ Coke. Per Cent.	Nitrogen in Na_2CO_3 Residue. Grms.	Percentage of original Nitrogen in Na_2CO_3 Coke. Per Cent.
Splint coal	0.0150	0.0095	63.3	0.0018	12.3	0.0097	64.7	0.0148	98.7
" "	...	...	...	...	...	0.0097*	64.7	...	...
Ell coal	0.0153	0.0101	66.0	0.0036	23.5	0.0116	75.8	0.0140	91.5
Bannockburn Main coal....	0.0189	0.0125	66.1	0.0140	74.0	0.0126	66.7	0.0158	83.6
Kilsyth coking coal.....	0.0204	0.0119	58.3	0.0174	85.3	0.0144	70.6	0.0156	76.5

* Lime water was used instead of milk of lime.

It is pointed out that when the substitution of the gaseous hydrogen by sodium is accompanied by the evolution of a considerable amount of heat (144 to 150), the salts are not hydrolyzed to any extent when dissolved in water. But, on the other hand, alkali sulphides and cyanides, which have a much smaller heat of substitution, undergo considerable dissociation in water, whilst alkali carbides are completely dissociated.

The substitution of the hydrogen by silver gives much more divergent results, the heat varying with each acid, and being negative with some, and notably with acetylene. The salts are not decomposed, however, by cold water, since there would be a considerable heat of formation in the separation of the silver oxide, which would occur if decomposition took place.

In the reactions taking place between water and carbides, two opposite phenomena are to be observed. Some carbides are decomposed with the formation of metallic oxides or hydroxides and acetylene, whilst, conversely, certain hydroxides are acted upon by acetylene with the formation of carbides, as in the equation—

$$C_2H_2 + Ag_2O = C_2Ag_2 + H_2O.$$

On this point the authors remark that given the heat of formation A, of a carbide C_2M_2, from the elements, and the heat of formation 2Q, of a hydroxide 2ROH, the course of the reaction will depend on the direction of the inequality $A + 138 \gtrless 2Q - 58.1$, if one takes into account only the formation of acetylene by the action of water on the metallic carbide.

The authors have also examined the nitrates, sulphates, chlorides and iodides of what they term "argentacetyl," in which the radicle C_2Ag_2 appears to play the same part as silver. They have had certain indications of the existence of an intermediate radicle, C_2HAg_2, but leave the question unsettled.

Argentacetyl nitrate $(C_2Ag_2)NO_3$ is obtained by the action of acetylene on a solution of silver nitrate. It is strongly explosive. It is decomposed by hydrochloric acid with the liberation of acetylene, and by an excess of ammonia in solution, with the formation of silver carbide—

$$(C_2Ag_2)NO_3 + 2NH_3 = C_2Ag_2 + NO_3NH_4[NH_4AG].$$

Nitric acid also decomposes it and yields crystals of silver cyanide.

There are several argentacetyl sulphates. The double sulphate $(C_2Ag_2.Ag.SO_4)$ is obtained by the direct action of gaseous acetylene on a solution of silver sulphate in excess. It is a white salt, which explodes feebly *in vacuo*.

If the current of acetylene be continued, the white precipitate becomes yellow, and the whole of the silver is precipitated, forming a compound with a composition corresponding to the formula $(C_2Ag_2)_2SO_4 + C_2Ag_2.Ag.SO_4$. By leaving this compound sulphate in prolonged contact with an aqueous solution of acetylene, the authors have succeeded in obtaining the normal sulphate $(C_2Ag_2)_2SO_4$.

Several chlorides of argentacetyl have been isolated. By dissolving freshly precipitated silver chloride in concentrated ammonium dydroxide, and passing a feeble current of acetylene through the liquid until the first appearance of a yellow color, a white precipitate is obtained with the composition $(C_2Ag_2)Cl$. It has feeble explosive properties. When an ammoniacal solution of silver chloride is mixed with sufficient hydrochloric acid to nearly precipitate the salt, and a current of acetylene passed through, a lemon-yellow precipitate is obtained, the composition of which agrees with the formula—

$$C_2Ag_2Cl,\ C_2Ag_2 \text{ or } C_2Ag_2(C_2Ag_2)Cl.$$

This has greater detonating properties than the preceding chloride.

By prolonging the action of the acetylene precipitates more and more yellow are obtained, such as, for example, one corresponding to the formula $C_2Ag_2Cl,\ 2C_2Ag_2$. There are also several iodides. Silver iodide dissolved in potassium iodide solution is not precipitated by acetylene even after the addition of ammonia; but if a small quantity of potassium hydroxide be added, a precipitate is gradually formed, especially on shaking the liquid in a closed vessel. If this precipitate be filtered off and the current of acetylene continued, a fresh precipitate of identical composition is produced. When washed successively with concentrated and dilute solutions of potassium iodide, and then with water, these have a composition corresponding with the formula $C_2Ag_2I + AgI$. This salt detonates feebly.

The authors have obtained an analogous double iodide of "cuproacetyl" with the formula C_2Cu_2I,CuI.

By acting upon argentacetyl nitrate with a solution of potassium iodide, and arresting the reaction as soon as the liquid becomes alkaline, a green precipitate is formed, having the composition $C_2Ag_2 + AgI$, or C_2Ag_2I. This compound has strong detonating power

On the Analysis of Manufactured Indiarubber.

By Dr. R. Henriques, in *Angewandte Chemie.*

During the years 1892, 1893, and 1894, I published the results of a research undertaken with the object of establishing analytical methods applicable to the treatment of manufactured indiarubber (*Moniteur Scientifique*, August, 1894, p. 617). The methods I then described have, as a rule, proved of practical value, not only in my own laboratory, but also in the hands of a certain number of colleagues employed in this industry. With practice I have since been able to simplify certain of these methods, and I now think the time has arrived for publishing the results obtained since the publication of my first papers.

I.—*Estimation of the Total Sulphur and the Mineral Constituents.*—The method finally adopted is as follows: A hemispherical porcelain crucible, about 6 c.m. in diameter, and of about 30 c.c. capacity, is covered with a watch glass, allowing room for a glass stirring rod. This crucible is filled to about one third, that is to say, with about 10 c.c. of pure concentrated nitric acid, and heated gently on a water bath. One grm. of the finely divided sample is weighed out, and gradually added to the acid. The reaction soon commences with the disengagement of reddish fumes. This must be regulated by adding fresh portions of the substance in such quantities that the reaction keeps lively without getting too strong.

This can easily be done by either removing the crucible from the water bath, repeating, if necessary, and varying the quantity of the substance added. When the attack is finished the heating is continued until the disaggregation is complete. There is now no longer any loss to be feared by projection; the watch glass can therefore be removed and wiped with a filter paper, which is placed in the crucible, and the evaporation is continued until the liquid takes a syrupy consistency. Twenty c.c. of acid are then added, and the concentration repeated and carried as far as possible so as to drive off all excess of acid.

There now remains to entirely destroy the organic matter. For this purpose we add to the syrupy extract a suitable dose of a mixture of dry soda (5 parts) and saltpetre (3 parts), and knead it well with the stirring rod so as to form an apparently dry powder. This is then covered with a layer of the mixture of soda and saltpetre, of which about 5 grms. is required altogether, and left on the water bath until no more carbonic acid gas is given off. To prevent all chance of deflagration, which might lead to losses, the calcination should be conducted very carefully. The crucible must be placed over a very small flame, which must be increased very gradually after some minutes, after having covered the crucible with another similar one so as to form a dome over it. If by chance the combustion becomes too fierce at any moment the projections will be stopped by the cover, and the substance thus caught must be melted apart, with a fresh dose of the oxidizing mixture.

Under ordinary circumstances the mass gradually becomes black from the edges towards the center, and only gives off empyreumatic fumes, which condense in the covering crucible, forming brown stains absolutely free from sulphur.

The first calcination once completed, the cover may be removed, and the substance heated to fusion, which can be accelerated by stirring with the glass rod. The entire operation of fusing requires from an hour to an hour and a-half. With a little practice it is easy to prevent any loss by deflagration. As a further precaution, it is as well, besides the careful regulation of the calcination, to use a very homogeneous mixture of soda and saltpetre, passed through a fine sieve, and thoroughly mixed with the nitric extract.

When the calcination is conducted without any deflagration, the same crucible can be made to serve for several operations. After cooling, the mass is taken up with boiling water and thrown on a filter. The whole of the sulphur in the sample will be found in the solution in the form of sulphate, and the metals remain on the filter in the form of oxides or carbonates, with the silica; it is only when this latter is present in considerable quantities that a part of it will be found in the solution. The solution is acidulated with hydrochloric acid, evaporated to dryness on the water-bath, taken up with concentrated hydrochloric acid, the silica separated, and sulphate of barium precipitated in the usual manner.

The metallic oxides are taken up on the filter with warm hydrochloric acid, which leaves the silica only insoluble. In the hydrochloric solution the metallic oxides are estimated in the ordinary way.

When mercury is among the constituents of india rubber—in the form of cinnabar, for example, it is often met with in dental rubbers—it must be estimated separately by attacking with nitric acid, diluting with water, filtering and precipitating with sulphuretted hydrogen.

Cinnabar is not such a rare constituent of india rubber as might be supposed. Besides dental rubbers it is met with in certain fine hardened rubbers (stabilite), and in small quantities in many red rubbers, where it is associated with vermillion or golden sulphide of antimony, or even with oxide of iron, the color of which it modifies to a certain extent.

II.—*Estimation of Factitious Matter in Vulcanized India-Rubbers.*—The method previously described (*Monitieur Scientifique*, Aug., 1894, p. 617) has not been appreciably modified. Although it is rather long we have not succeeded in shortening the time occupied without interfering with its exactness. The only modification which has been introduced consists in the following, that instead of collecting the rubber exhausted with alcoholic potash on a tared filter, for the purpose of weighing by difference, we simply use any filter, from which the material becomes detached with the greatest ease during the drying in the oven. The complete desiccation is then effected separately and the weighing done direct.

III.—*Estimation of Non Saponifiable Oils in Vulcanized Mixtures.*—The non-saponifiable oils, mineral oils, resin and paraffine are often met with in commercial rubber, not only because the manufacturer adds a certain proportion to render the re-heating and cutting more easy, but also because several factitious rubbers and most regenerated or devulcanized rubbers contain them in notable proportions.

The estimation of these bodies is effected at the same time as that of the factitious matter. After treating the sample with alcoholic potash and weighing the residue, the latter is taken up by several applications of ether, which easily and completely dissolves all the non-saponifiable oils. The sample is simply ground with ether in a mortar and decanted, the rubber remaining well agglomerated. This extraction is continued as long as the solvent becomes colored; the sample is then dried again, and the difference in weight is taken as non-saponifiable oil. It is on the residue from this extraction that the estimation of the combined sulphur and ash is effected, for the calculation of the approximate proportion of factitious matter present.

IV.—*Estimation of Factitious Matter in Non-Vulcanized India-Rubbers.*—The method of estimating factitious matter, such as already described (*loc. cit.*), gives very concordant results in the analysis of commercial vulcanized rubbers. It is applicable equally to the analysis of blocks or sheets of patent rubber, cut or otherwise, but it cannot be applied without modification to raw cut rubbers, that is to say, to mixtures prepared for vulcanization.

Even after four hours boiling with alcoholic soda, the factitious matter is not entirely dissolved, and on repeating the extraction a fresh loss of weight is observed, which, however, does not even then correspond to the total amount of factitious matter contained in the mixture. As we already know that the factitious matter is entirely soluble in alcoholic soda and that the rubber itself is not soluble at all, this result can only be attributed to mechanical action, the thickness of the pieces preventing the interior layers from being reached by the solvent. To remove this difficulty I operated as follows:

Five grms. of the material were placed in an Erlennmeyer flask, in contact with 25 c.c. of benzene. This was heated for an hour on a water bath, after fitting a vertical condenser, and left to macerate for a night. The mass is by this time converted into a thick glue, to which is added 25 c.c. of normal alcoholic soda solution. After boiling again in the same manner for four hours, and then distilling off the solvents, the residue is taken up with boiling water. The whole is placed in a crucible, treated several times with water, and the coagulum of rubber separated. Filtering is useless, and the whole material is collected in a pasty mass, which is ground in a mortar with boiling water until all alkaline reaction disappears.

The proof that under these conditions the elimination of the factitious matter is complete, is furnished by the analysis of the remaining rubber, which does not contain a trace of sulphur. Further, a second extraction, conducted in the same manner, gives no supplementary loss of weight. The results of three analyses agree to within 1 per cent.

V.—*Estimation of Non Saponifiable Oils in Non Vulcanized Rubbers.*—With non-vulcanized rubbers it is impossible to apply the method of estimation of non saponifiable matter, described in paragraph III., on account of the partial solubility of the india rubber itself in ether. In this case we make use of acetone, with which the rubber, freed from factitious matter and free sulphur, is boiled as in paragraphs II. and IV. The extraction by boiling is continued until the solvent is no longer colored. The rubber then remains in a pasty, gluey state, which is very difficult to dry for the purpose of weighing. Further, it is preferable to weigh the dissolved material direct; for this purpose the acetone extracts are filtered hot in a mattress, and after distilling off the acetone the residue is taken up with a little ether and left to evaporate spontaneously after filtration; the residue is then dried in the oven at 100° and weighed.

Cold acetone does not easily dissolve the non-saponifiable substances met with in india rubbers; but on boiling they are dissolved quite sufficiently to enable the total extraction to be accomplished without difficulty.

VI. Estimation of Carbonic Acid.—Carbonates are frequently used in the manufacture of india rubber, particularly chalk and carbonate of magnesia, but we also occasionally meet with ceruse and carbonate of zinc (?). As, on the other hand, the oxides corresponding to these carbonates are often met with, it is interesting, in certain cases to estimate the carbonic acid exactly. For this purpose a Geissler apparatus is used according to the directions given by Fresenius. It is essential that the rubber analyzed should be of extreme fineness, and further—as vulcanized india rubbers may contain sulphides, either through their being added, as in lithopone, or through their formation during the vulcanization, by the action of sulphur on the metallic oxides—care must be taken that the carbonic acid gas given off does not carry with it any sulphuretted hydrogen.

For this purpose it suffices to replace the water with which the apparatus is charged, with a dilute solution of sulphate of copper. The carbonic acid gas which is then given off is entirely free from sulphuretted hydrogen.

This method, when used for the analysis of a non-vulcanized rubber, only gives bad results. In such a case, no matter how finely the sample may be divided, the hydrochloric acid is unable to reach the whole of the carbonate which is protected by the rubber; the attack, therefore, remains superficial. It is then necessary to have recourse to the preliminary extraction of the sample with nitrobenzene as proposed by O. Weber.

We operate on a few grms. of material which are boiled with nitrobenzene; the material is then washed with benzene, collected on a filter, dried, weighed, and an aliquot part taken for the estimation of the carbonic acid. The attack of the substance, which has now become pulverulent, is very rapid.

I might here remark that I have not, on many occasions, been able to obtain satisfactory results when following the method proposed by Weber, either in its original form or in the improved form which he has since devised. Non-vulcanized, or slightly vulcanized rubber, it is true, dissolves in boiling nitrobenzene, but if we have to deal with hard or highly charged rubbers it is very difficult to dissolve the whole of the gum, and the filtration of the residue presents insurmountable difficulties.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

"OBSERVER," writing from Boston, Mass., under date of January 30, says: "The recent decision of the Massachusetts Board of Gas and Electric Light Commissioners, recommending the reduction of price of gas in Haverhill to 80 cents per 1,000 cubic feet on February 1st, bids fair to bring about a vast amount of agitation as to the proper price for gas in the various Massachusetts cities and towns, and is causing much uneasiness among gas officials and shareholders. Haverhill is an inland city of some 35,000 population, with a sendout of gas of some 90 millions cubic feet. Many years ago, when a small town, its Gas Company was started with a capital of $75,000. Although selling gas at a price which was always very low, the Company, by close and conservative management, has increased its property out of its surplus, up to the point where now it is estimated to have a plant valued at some $300,000. Had it increased its capital by all or even a portion of this increase of valuation, it is doubtful if the present condition of affairs would have been brought about. The laws of Massachusetts, as existing for several years, have prevented stock dividends, and discouraged the additional issue of capital. Beside this, many of the older companies have believed it wise to keep down their capital to the lowest possible point. This has tended, as exemplified in the Haverhill case, to the injury of many companies. Following the sequence of events, this discrepancy between capital and assets finally attracted the attention of capitalists from outside the State, who purchased the entire stock of the Haverhill Company for something under $500,000, and proceeded to form the Haverhill Gas Securities Company, with $500,000 of bonds bearing 5 per cent. per annum, and $500,000 capital stock, whose sole asset and earning power were the shares of the Haverhill Gas Light Company. The people of Haverhill, evidently believing that the necessity of earning these fixed charges would act against their interests, petitioned the Board of Gas and Electric Light Commissioners for a reduction in the price of gas, with the result that, after extended hearings, the Board recommends, which is in effect an order, the reduction of the selling rate to 80 cents per 1,000, the 1st prox. The Board in its decision says in effect, that the accumulation of a surplus imposes upon a company the joint duty of employing it for the

benefit of the consumer and company; for the consumer by making minor extensions, without burdening him with additional capital; for the company, by balancing the value of its securities, and in bringing to its shareholders a somewhat higher return than they might be entitled to otherwise. But in this case the Board believes that the Securities Company has attempted to indirectly capitalize the entire surplus and intends to take out of the Gas Light Company that portion of the profits which should be reserved for the joint benefit of consumer and corporation. The action of the Board, however, seems to be extreme, and is so regarded by shareholders and investors. Brokers report a falling off in prices of gas securities coming to their notice, and a withdrawal of bids. It is held that the extreme reduction, coming as it does on the present market, will prevent the Company showing any profit in its trading. Evidence in the hearing showed that gas had cost the Company about 63 cents per 1,000 cubic feet sold. It is claimed that the great increase in the cost of coal, oil and other materials will add at least 15 cents to the cost per 1,000 for the ensuing year, and that the cost in Haverhill will practically equal the selling price. Hence the shareholder and investor fear that no matter what may be the disposition of the Board towards well-managed companies, it will be impossible to resist the demand for lower prices, and prices comparable with Haverhill one. Certainly their arguments are so far borne out by the facts, for already demands have been made for reductions in gas rates in Boston, East Boston, Lowell, and other places. Several bills are in the Legislature asking for reductions in the Boston gas rate anywhere to and between 50 cents to 75 cents per 1,000 cubic feet, and the Boston parties who, by such extensive advertising of a year or more ago, sowed the wind of 35 and 50 cent gas, will reap a whirlwind which is liable to blow their gas securities out of sight. It is not believed that the Haverhill Company will attempt the apparently impossible task set by the Commission, but will appeal to the Courts. In such an event the matter of reduction may be indefinitely prolonged, in Haverhill and elsewhere."

AT a recent meeting of the proprietors of the Dover (Del.) Gas Light Company it was voted that the selling rate should be put at $1.40 per 1,000 cubic feet, with a discount of 10 per cent. for prompt payment—within 15 days. The rate was made retroactive from January 1st.

MR. DWIGHT F. BURRITT, whose resignation as Manager of the Rockville (Conn.) Gas and Electric Company was recently reported in the JOURNAL, has been appointed Manager of the Palmer and Monson (Mass.) Street Railway Company. He will also have supervision of the properties of the Central Massachusetts Electric Company.

THAT "pure politician," Senator Coggeshall, has introduced a bill in "the upper branch" of the New York legislature, which among other things, directs "That no corporation, association, company, copartnership or person shall charge or receive for illuminating or fuel gas furnished or supplied to the inhabitants of the City of Utica a greater rate than $1 per 1,000 cubic feet."

MR. BENJAMIN J. MCDONALD, for many years Secretary and Treasurer of the Consumers Gas Company, of Newburgh, N. Y., will act as President of the Company until a successor to the late Mr. John C. Adams is chosen at its next annual meeting. Unless all signs fail, Mr McDonald will eventually be named as President of the Company who in the past has gained much from his constant and competent service.

AT the annual meeting of the Middletown (N. Y.) Gas and Electric Light Company the officers elected were: Directors, L. C. Purdy, Philip Jackson, T. L Reeve, Archibald Taylor, C. L. Mead, J. W. Canfield and J. F. Ried; President, L. C. Purdy; Vice-President, Philip Jackson; Secretary, T. L. Reeve; Treasurer, Archibald Taylor.

MR. E. G. COWDERY denies that he is in any sense interested in the proposition to amalgamate the artificial lighting interests of Evanston and Waukegan, Ills.

MR. WILSON LUCKING has been appointed Official Gas Inspector for Detroit, Mich., vice Mr. Charles Krecke, resigned.

THE residents of Deering, Maine, which is virtually a suburb of Portland, are anxious that the Portland Gas Company shall extend its mains through their streets.

AT the annual meeting of the Waterbury (Conn.) Gas Light Company no change was made in the personnel of its executive management.

MR. A. P. LATHROP, Secretary and Treasurer of the Columbus (O.) Gas Company, has resigned that dual position to accept the posts of Vice-President and General Manager of the St. Paul (Minn.) Gas Company. He assumed his new duties on the 1st inst.

THE Albany and Hudson Railway and Power Company has placed the contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for its power house and the several bridges required for the extension of its line from Albany to Hudson, N Y. The line will require nine spans of plate girder bridges, varying in length from 30 feet to 65 feet, with a viaduct over the tracks of the B. & A. Railroad and the N. Y. Central & Hudson River Railroad. This viaduct will require something over 1,000 tons, it being 2,000 feet length. The span over the B. & A. is 175 feet, pin connected, and that over the N.Y.C. & H. River is over 200 feet in length. The work is to be completed in the early spring.

AT the annual meeting of the stockholders of the Norwich (Conn.) Gas and Electric Company the Directors chosen were: E. N. Gibbs, Morris F. Tyler, George E. Terry, A. M. Young, Frank T. Brown, Arthur H. Brewer and S. B. Much.

MR. WM. C. ANDERSON, Superintendent of the Consolidated Gas Company (New Jersey), Red Bank station, has accepted a position with the Gas Company of Montgomery County, Norristown, Pa.

AT the annual meeting of the San Francisco (Cal.) Gas and Electric Company the following Directors were elected: Joseph B. Crockett, Peter Donahue, Adam Grant, Charles E Green, J. D. Harris, Daniel T. Murphy, George W. Prescott, A. H. Payson, Levi Strauss, Thomas B. Bishop and W. F. Whittier.

MR. WILLIAM H. SPAULDING, of Clinton, Mass., has been appointed Superintendent of the Westerly (R. I.) Gas and Electric Light Company.

MR. RALPH T. IVES, of Southington, Conn., has purchased a controlling interest in the Wallingford (Conn.) Gas Light Company, and will assume the active management of its business.

"L. R. C" is informed that, at the annual meeting of the Niagara Falls (N Y.) Gas Light Company, changes were made in the management, the controlling force in the latter just now seemingly being Senator Humphrey, of Warsaw, N. Y. Perhaps the best answer to the query will be the following listing of the officers selected: President, F. A. Dudley; Vice-President, L. H. Humphrey; Secretary, A. C. Hastings; Treasurer, G. C. Shepard; General Manager, C. L. Ingraham; Supt., L. A. Boore.

"LAST week I read your note concerning the pensioning by the Company of Mr. William H. Havens, who since 1862 had been a faithful employee of the Hudson County Gas Light Company, of Hoboken, N. J. I am sorry to say that his death occurred the evening of January 26th. I enclose an obituary note respecting his career, which I hope you can find space to print.—L. T."

THE inclosure by our correspondent reads: "Mr. William H. Havens, who for many years was General Agent for the Hudson County Gas Light Company, died suddenly at his home, 906 Garden street, Hoboken, the night of January 26th. Considerable surprise was occasioned by the announcement, for no sign of illness had been shown by him. He was a well known resident of Hoboken, where he lived over three score years. He was said to be the oldest resident of the city. He had a large acquaintance and was esteemed by every one who knew him. Mr. Havens was in the service of the Hudson County Gas Light Company for 37 years as General Agent, and managed the affairs of the Hoboken office. He was one of the men who started the Company and was the last one of the organizers to die. When the new Company absorbed the old one Mr. Havens was pensioned. At one time Mr. Havens took a very active part in Hoboken politics and was an ardent Democrat. He served as a member of the Hoboken Common Council and School Board. The flags were placed at half mast on all public buildings. He was very well known in Masonic circles, being a prominent member of Hoboken Lodge, F. and A. M. He was also a member of Columbia Lodge, No 63, I O.O.F.; Hudson County Council, No. 674, R. A., and also the Hoboken Ferrymen's Association. Mr. Havens was for a number of years President of the Hoboken Cemetery. Mr. Havens was in his 72d year. A wife and two children survive him. The funeral services were held on Monday evening, Jan. 29th, Rev. H. T. Beatty, of the First Presbyterian Church, officiating. Interment was made in Hoboken cemetery."

THE AMERICAN GAS LIGHT JOURNAL

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MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

MONDAY, FEB. 5, 1900.

The Market for Gas Securities.

There was no move of importance made during the week in the local gas situation, unless a curious spurt in New Amsterdams may be regarded with curiosity. The common sold up to over 26, and to-day (Friday) it is quoted at 25½ to 26½. Why it should be worth more this week than it was last week is a puzzler. Consolidated sold to day at 192, and the close for it was 190½ to 192. This afternoon Mr. Frank Tilford was elected President of the Standard Gas Light Company, vice Mr. R. Sage, "resigned"; and Mr. Oliver S. Carter was elected Vice-President. There is persistent inquiry for Mutual.

Brooklyn Union is in for a speedy advance, simply on its earnings, and entirely independent of any figure it may cut in the eventual consolidation of the artificial lighting interests of the greater city. Peoples, of Chicago, shows an advance of 5 points for the week. Bay State seems to have taken on a new lease of life, and is "over 2." The list as a whole is strong.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEB. 5.

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	190½	192
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	18
Metropolitan Bonds	658,000	.	108	112
Mutual	3,500,000	100	275	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	25¾	26¼
Preferred	10,000,000	100	45½	46½
Bonds, 5's	11,000,000	1,000	94½	96½
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River,				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000		115	..
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000		..
Standard	5,000,000	100	115	..
Preferred	5,000,000	100	125	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,65	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	143½	150
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	2½	2¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	40	..
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	4	7
" " Bonds, 5's	5,250,000	1,000	72	75
Central, San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	108
Columbus (O.) Gas Lt. & Heating Co	1,682,780	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	193½	194½
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		..
Consolidated, Baltimore	11,000,000	100	56	56¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	21	23
" Con. Mtg. 5's	880,000	1,000	87	90
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	95¾	96
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	38	45
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	100	105
" Bonds, 6's	2 650,000	..	101	103
Jackson Gas Co.	250,000	50	72	78
" 1st Mtg. 5's	250,000	1,000	101	102½
Lafayette Gas Co., Ind.	1,000,000	100	40	45
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	106	
Laclede, St. Louis	7,500,000	100	79½	80
Preferred	2,500,000	100	95	101
Bonds	10,000,000	1,000	110	110½
Madison Gas & Elec. Co.	400,000	100	82	..
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	16,000,000	..	50	60
Bonds, 6's	4,600,000	..	107	108
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	43	45
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	107¾	108
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111⅝	111½x
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	49	50
St. Paul Gas Light Co.	1,500,000	100	57½	58½
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	88	90½
St. Joseph Gas Co.	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	..	15
Bonds	1,612 000	1,000	85	90
Washington, D. C	2,000,000	20	285	..
First mortgage 6's	600,000	..	.	..
Western, Milwaukee	4,000,000	100	106¾	107¾
Bonds, 5's	3,330,500	.	106	108
Wilmington, Del.	600,000		220	50

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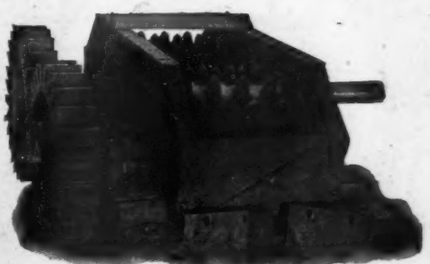
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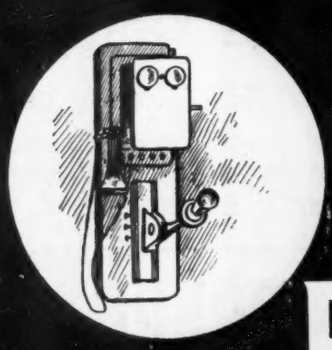

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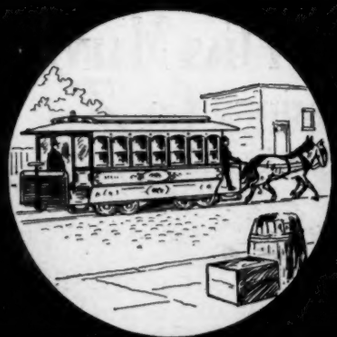

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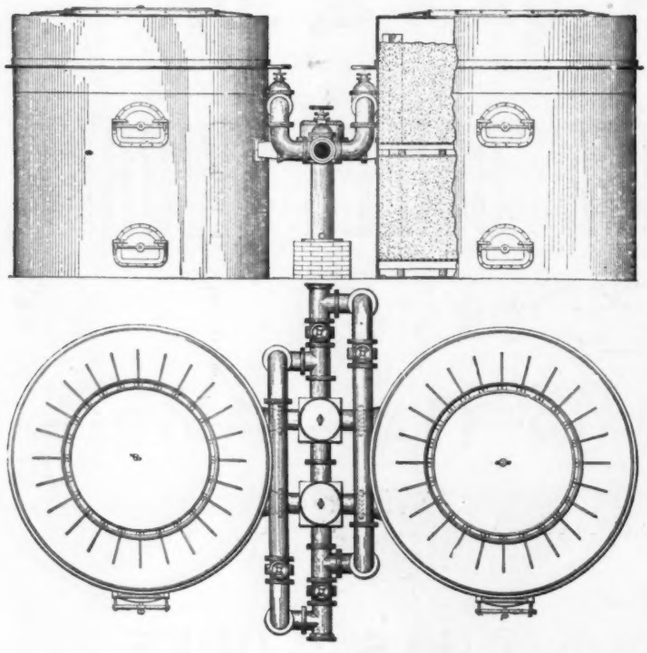

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Covered by Five U. S. Patents.

In operation, revivification of the oxide is effected by repeated reversals of the direction of the flow of the gas through the beds (in the two boxes used under this system there are eight different routes for the gas to take) whereby the purified gas is made to revive the oxide in parts of the apparatus while the foul gas is fouling it in others.

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There are no Hydraulic Cups or heavy covers.

Either end of the apparatus is inlet or outlet at pleasure.

The capacity is increased five-fold or more over ordinary methods without addition to building.

The apparatus costs less than for any other system.

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Windsor Street Works, Birmingham, Eng.	2,000,000
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Colchester, Eng.	300,000
Birkenhead, Eng.	2,250,000
Swindon (New Swindon Gas Co.), Eng.	120,000
Saltley Works, Birmingham, Eng. (2d Contract)	2,000,000
Windsor St. W'ks, Birming'm, Eng. (2d Contract)	2,000,000
Halifax, Eng.	1,000,000
Toronto,	250,000
Ottawa,	250,000
Toronto (Second Contract, Remodeled),	2,000,000
Lindsay (Remodeled),	125,000
Belleville,	250,000
Ottawa (Second Contract),	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled),	250,000
Kingston, Pa.	125,000
Montreal,	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract),	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, Eng. (Second Contract),	300,000
York, Eng.	750,000
Rochester, Eng.	500,000
Kingston, Ont.	300,000
Crystal Palace District, Eng.	2,000,000
Duluth, Minn.	300,000
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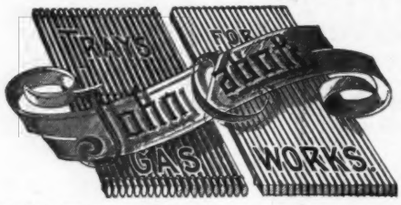

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Having compiled a novel Chart or Map illustrating the various

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In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

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87	"	.	4 "	.	5¼	"	"	
160	"	.	5 "	.	6½	"	"	
219	"	.	6 "	.	8	"	"	
176	"	.	7 "	.	9¾	"	"	
291	"	.	8 "	.	11¼	"	"	
97	"	.	9 "	.	13	"	"	
116	"	.	10 "	.	15	"	"	
87	"	.	10 "	.	16	"	"	
110	"	.	12 "	.	20½	"	"	

I BEAMS.

101	bars	.	3-inch	.	5½	pounds	per	ft.
216	"	.	4 "	.	7½	"	"	
110	"	.	5 "	.	9¾	"	"	
87	"	.	6 "	.	12¼	"	"	
191	"	.	7 "	.	15	"	"	
116	"	.	8 "	.	17½	"	"	
127	"	.	9 "	.	21	"	"	
114	"	.	10 "	.	25	"	"	
87	"	.	12 "	.	31½	"	"	
62	"	.	12 "	.	40	"	"	
101	"	.	15 "	.	42	"	"	
175	"	.	15 "	.	50	"	"	
42	"	.	15 "	.	60	"	"	
160	"	.	20 "	.	65	"	"	

In addition we also have all sizes of Angles both with even and uneven legs, from 1 x 1 x ⅛ in. to 6 x 6 x ¾ in., and Plates from 6 in. to 60 in. in width. We also have a fair stock of Zee bars, Tee iron and special shapes. All of this material in lengths from 40 ft. to 50 ft. We can ship promptly, and should be pleased to receive your order. Prices on Application.

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MORE DIRECT IN ACTION. FEWER PARTS.
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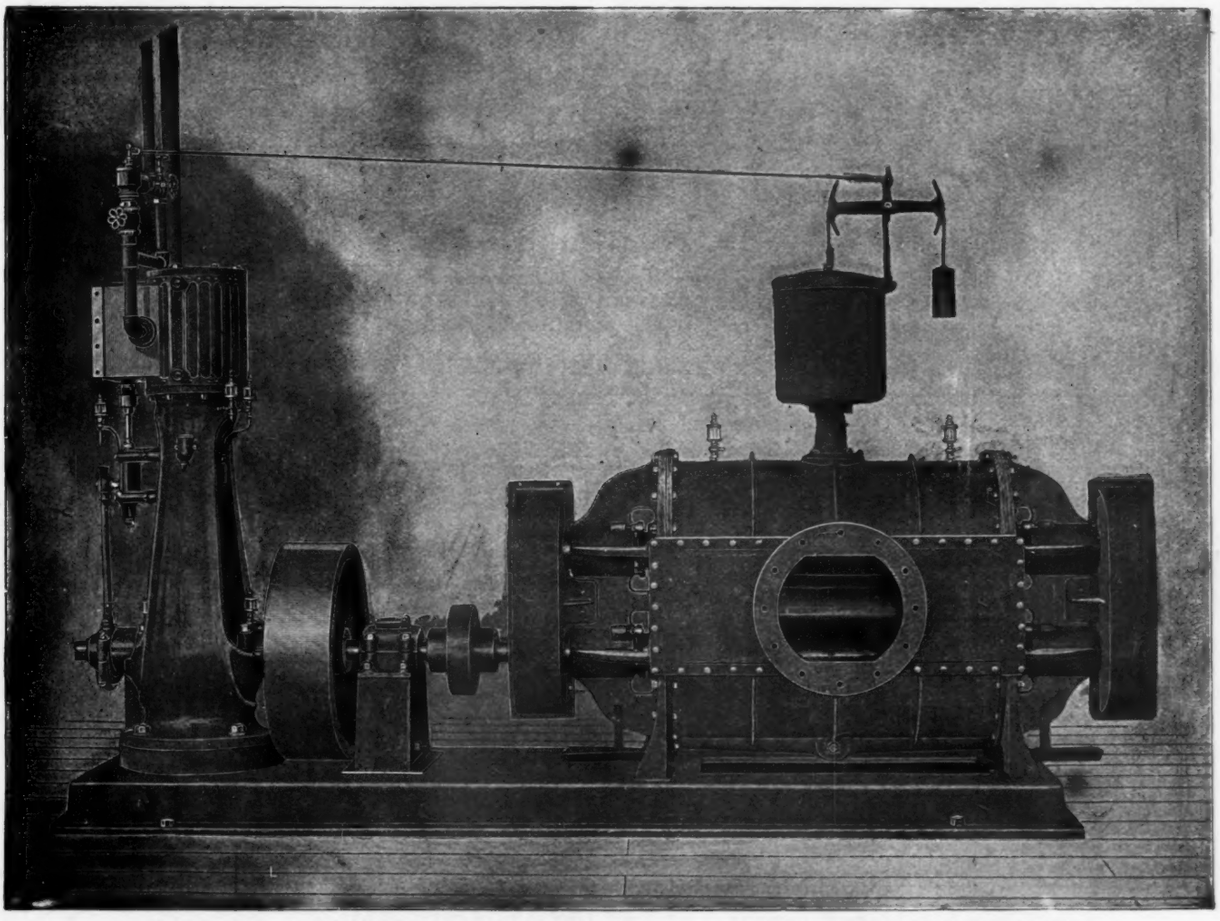

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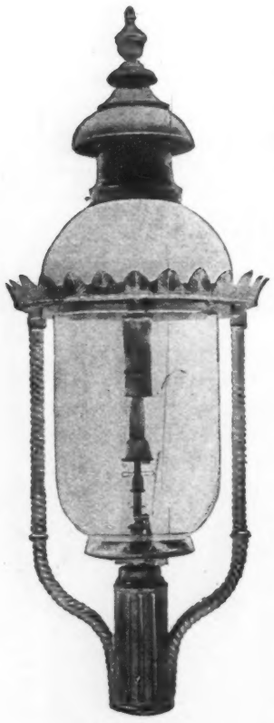

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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

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By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

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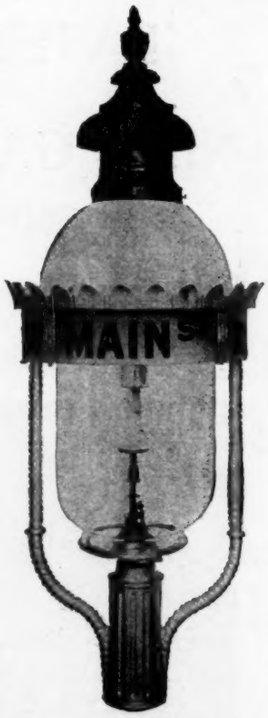
Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.



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This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

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With Instructions for Care and Working of the Same.

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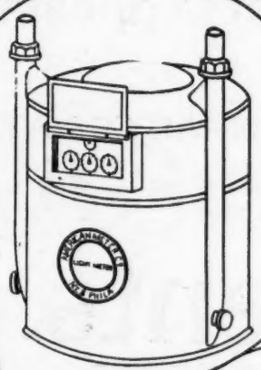
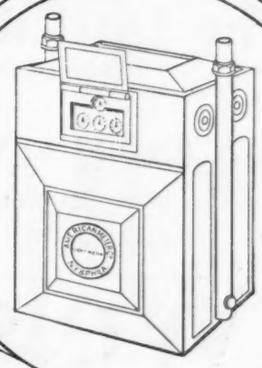
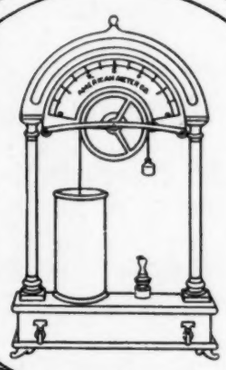


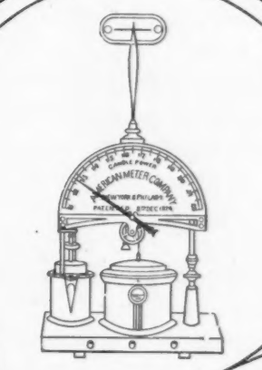


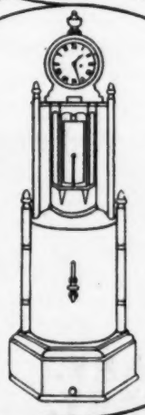
PUBLIC LIGHTING TABLE.

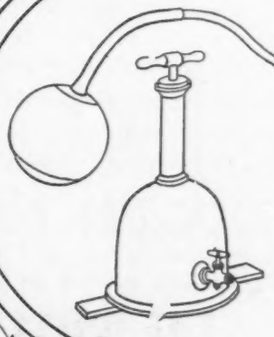
FEBRUARY, 1900.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	5.50 PM	6.10 AM	5.05	6.15
Fri.	2	5.50	6.10	5.05	6.15
Sat.	3	5.50	6.10	5.05	6.15
Sun.	4	10.20	6.00	5.05	6.15
Mon.	5	11 30	6.00	5.10	6.10
Tue.	6	12.40 AM FQ	6.00	5.10	6.10
Wed.	7	1.40	6.00	5.10	6.10
Thu.	8	2.30	6.00	5.10	6.10
Fri.	9	3.20	6.00	5.10	6.10
Sat.	10	4.00	6.00	5.10	6.10
Sun.	11	4.40	6.00	5.10	6.10
Mon.	12	5.10	6.00	5.20	5.55
Tue.	13	No L.	No L.	5.20	5.55
Wed.	14	No L. FM	No L.	5.20	5.55
Thu.	15	No L.	No L.	5.20	5.55
Fri.	16	6.10 PM	9.00 PM	5.20	5.55
Sat.	17	6.10	9.50	5.20	5.55
Sun.	18	6.10	10.50	5.20	5.55
Mon.	19	6.10	11.50	5 30	5.55
Tue.	20	6.10	12.50 AM	5.30	5.55
Wed.	21	6.10	1.50	5.30	5.55
Thu.	22	6.10 LQ	2.50	5.30	5.55
Fri.	23	6.10	3.40	5.30	5.55
Sat.	24	6.10	4.40	5.30	5.55
Sun.	25	6.20	5.30	5.30	5.55
Mon.	26	6.20	5.30	5.30	5.45
Tue.	27	6.20	5.30	5.30	5.45
Wed.	28	6.20 NM	5.30	5.30	5.45



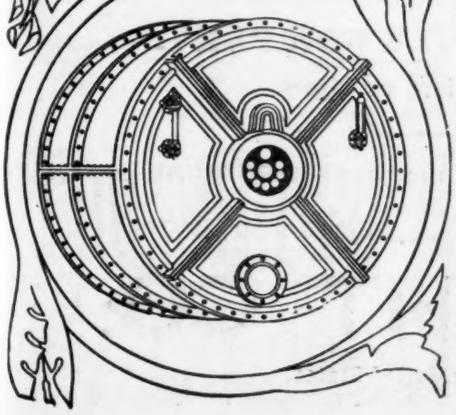


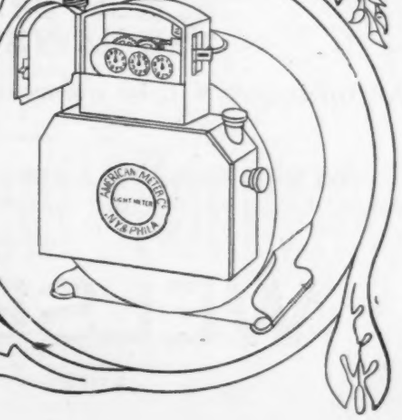




TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	230.50	January	423.20
February	175.40	February	355 25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152.00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr	2221.40	Total, yr	3987.45





THE RECENT DECISION.

The United States Circuit Court of Appeals,

In Its Opinion of December 7, 1899,

FINALLY AND FULLY SUSTAINS THE WELSBACH COMPANY'S PATENT.

DEALERS and USERS and MANUFACTURERS are CAUTIONED against INFRINGEMENT of the

Welsbach Patents.

Judge LACOMBE, in the United States Circuit Court, handed down the following opinion Saturday, Dec. 9, 1899.

On motion to restrain complainant from sending circulars to the customers of American Incandescent Lamp Company.

LACOMBE, Circuit Judge.

Irrespective entirely of the preliminary objection that affirmative relief of this sort will not be granted to defendant—a question not now passed upon—there seem no good grounds for criticism of complainant's circular. It states that Judge Townsend enjoined the "manufacture and sale" of infringing mantles, and he did grant such an injunction. And this Court has enjoined the sale of mantles which the person enjoined did not himself manufacture, when his past conduct in the matter of infringement created a special equity in favor of the complainant against him. It is true that the circular goes further, and threatens suit against persons who sell mantles, but who never have been at all concerned in manufacturing or causing them to be manufactured.

In other words, it threatens suit upon the patent as if it were a patent for a product. But the complainant insists that the threat is made in good faith; that it intends to bring suits against sellers of the infringing mantles upon the theory that the patent is really one for a product. In view of the peculiar language of the claim, this Court is not now prepared to hold that such contention would be wholly without merit, or that the complainant could not succeed against a mere seller. Moreover, it is contended that the seller of a purchased mantle himself promotes the taking of the final step in the process, and such contention has not yet been passed upon adversely to complainant. These are questions which should be left to be determined in one of such suits, rather than here. If complainant intends to prosecute one or more sellers, and there is nothing before the Court to induce a disbelief in its assertion that it does so intend, it would seem to be its proper course to warn dealers to desist from selling.

December 9, 1899.

Restraining orders issued in the United States Circuit Courts against—

THE UNITED INCANDESCENT LIGHT COMPANY.
ST. LOUIS INCANDESCENT MANTLE COMPANY.
ECKERLE ELECTRICAL COMPANY.
H. KUPFER.
THE NEWBY INCANDESCENT MANTLE COMPANY.

All infringers will be prosecuted, whether Manufacturers, Dealers or Users.

TO THE PUBLIC: Avoid Liability of infringement! Take nothing but the GENUINE always in sealed boxes bearing our registered trademark, "WELSBACH."

WELSBACH LIGHT CO.

Salesrooms in all the leading cities throughout the United States.

THE UNITED GAS IMPROVEMENT COMPANY.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Total Sets Installed to January 1, 1900, - - - - - - - - 327

Total Daily Capacity - - - - - - - - - 207,425,000 Cu. Ft.

WATER GAS PLANT AS AUXILIARY TO COAL GAS WORKS.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY. Sec.

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CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

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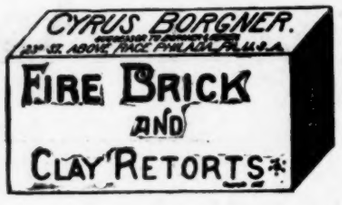

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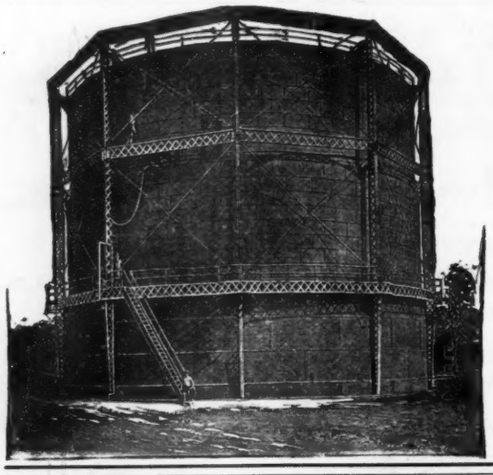

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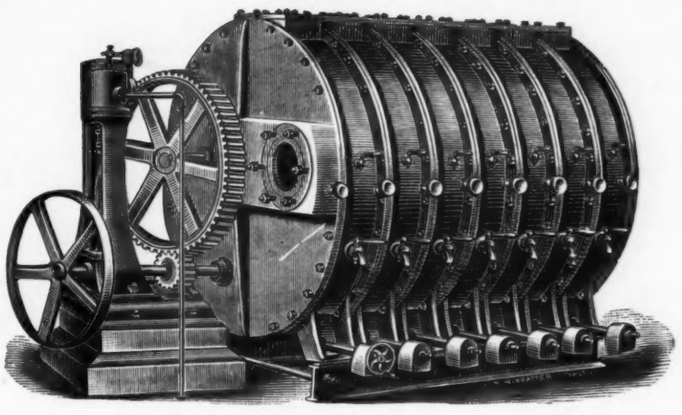

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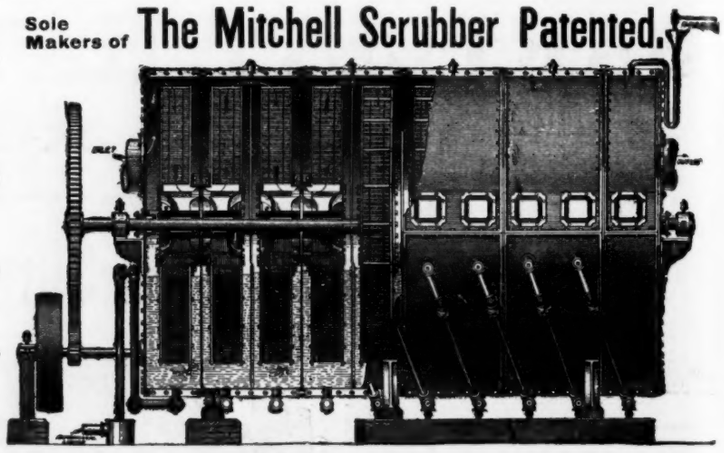

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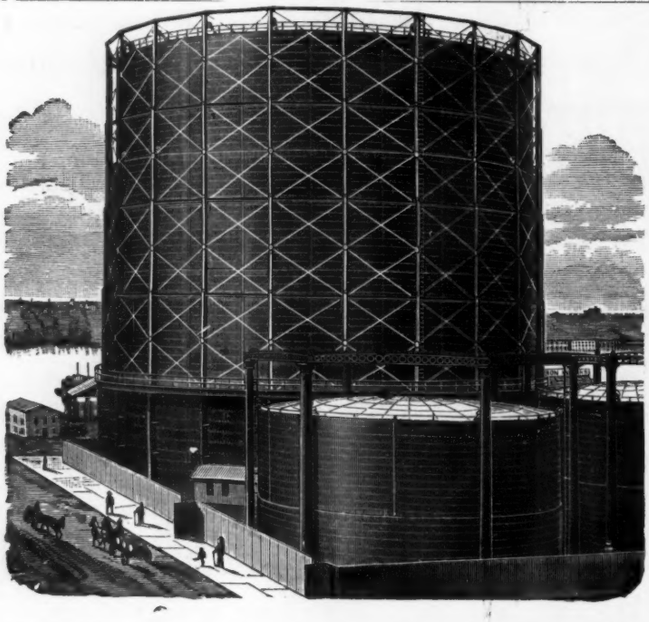

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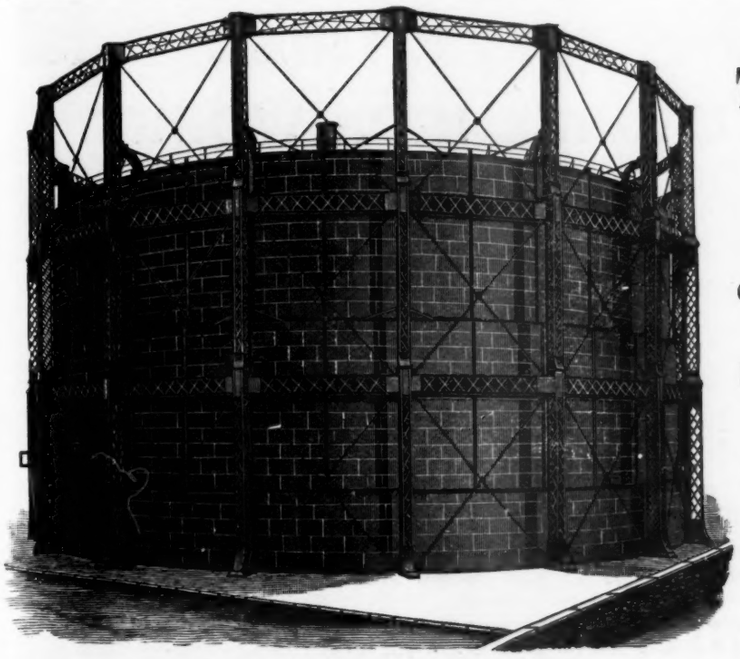

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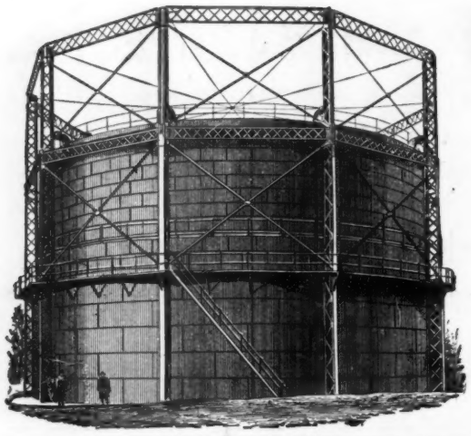

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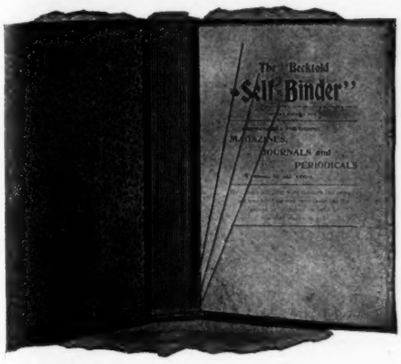

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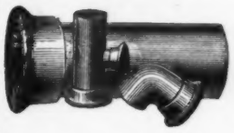

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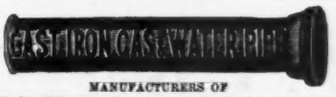

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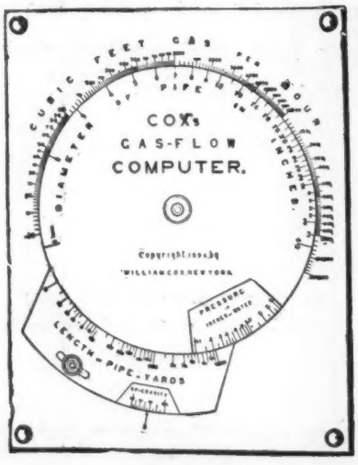

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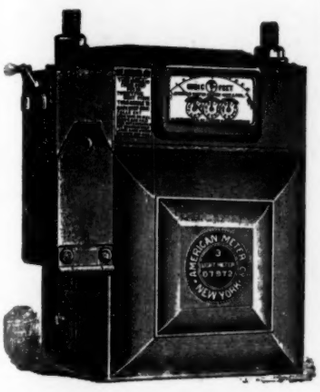

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